NUCLEAR SCIENCE ABSTRACTS

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April 15, 1975

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Volume 31, Number 7, April 15, 1975

NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

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- Zentralstelle für Atomkernenergie-Dokumentation (West Germany)

Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

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Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

CARTER, G., See REED, D.J., 30:21824
CASA, A.F., Nuclear energy in Japan, 30:23243
CASARETT, A.P., See KALLFELZ, F.A., 30:21411
CASCI, C., Method for preliminary analysis of MHD generator performance, 30:20916 (AGARD-CP-104)

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

REACTOR CONTROL SYSTEMS/PERFORMANCE
Optimization of control-rod programming in multiregion nuclear reactors, 30:23184
REACTOR COOLING SYSTEMS/TRANSIENTS
WFLASH: a FORTRAN-IV computer program for simulation of transients in a multi-loop PWR, 30:23171 (WCAP-8261(Rev.1))
REACTOR CORES/INSPECTION
Initial results of a holographic tomosynthesis technique for fuel-core inspection, 30:23198
REACTOR CORES/STRESS ANALYSIS
Methods of stress analysis in use at General Atomic for core design (HTGR graphite moderator), 30:23078 (GA-A-12870)

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

23214 (HEDL-TME-74-16) ANALYSIS OF TEMPERATURE PROFILES IN TRANSIENTLY HEATED UO_2 USING MOLYBDENUM INCLUSIONS. Wilmot, E. L. **(Hanford Engineering Development Lab., Richland, Wash. (USA)).** [nd]. Contract AT(45-1)-2170. 23p. AT.

is indexed as:

HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH. (USA)
Analysis of temperature profiles in transiently heated UO_2 using molybdenum inclusions, 30:23214 (HEDL-TME-74-16)
HEDL quarterly technical report, January--March 1974. Volume I. Materials technology, 30:21815 (HEDL-TME-74-1(Vol.1))
Modeling of the post-irradiation fuel-cladding gap in mixed-oxide fuels, 30:23103 (HEDL-TME-74-19)
Preliminary data report: post-irradiation examination of fuel pins PNL-10-23 and PNL-10-63, 30:23149 (HEDL-TME-74-23)
Prototype applications loop two years of operation, 30:20928 (HEDL-TME-74-24)

Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

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AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

Refer also to abstracts 17170, 17171, and 18609.

Activation and Nuclear Reaction Procedures

Refer also to abstracts 16045, 16647, 16913, 16917, 16918, 16931, 18546, 19070, and 19162.

15901 (CONF-7306108-, pp 27-38) NEUTRON SCATTERING TECHNIQUES. Jacrot, B. (Institut Max von Laue - Paul Langevin, Grenoble, France). Sep 1973.

From proceedings on trends in the use of nuclear radiation in science; Delft, Netherlands (15 Jun 1973).

In trends in the use of nuclear radiation in science.

After a short historical introduction mentioning the technical limitations on the use of neutrons, a survey is presented of work being done at Grenoble with the HFR reactor for the development of neutron detectors. The range of fields of application of neutron inelastic scattering and neutron diffraction is reviewed. (auth)

15902 (CONF-7306108-, pp 39-48) RESEARCH REACTOR AS A WINDOW ON THE WORLD. Lenihan, J. M. A. (Western Regional Hospital Board, Glasgow). Sep 1973.

From proceedings on trends in the use of nuclear radiation in science; Delft, Netherlands (15 Jun 1973).

In trends in the use of nuclear radiation in science.

Attention is paid to the impact of nuclear science and technology on chemistry, biology, medicine, and the study of the environment. (auth)

15903 (JINR-P14-8290) PROSPECTS OF USING THE NUCLEAR-PHYSICAL ANALYSIS METHODS IN BIOLOGY, EXEMPLIFIED BY THE WILT PROBLEM. Vyropaev, V. Ya.; Kharisov, I. F.; Maslov, O. D.; Zhuravleva, E. L.; Kul'kina, L. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Results are presented of nondestructive neutron activation analysis carried out to establish the content of microelements in the healthy cotton plants and in those affected by the wilt disease. It is shown that the neutron-activation method can be used to carry simultaneous multielement analysis of cotton with high sensitivity (up to 10^{-8} g/g). The contents of 25 elements were determined, 17 of which displayed anomalies in their concentrations in the different parts of the healthy and wilt-affected cotton plants. (auth)

15904 USE OF NEUTRON-ACTIVATION ANALYSIS OF OXYGEN IN THE DETERMINATION OF THE OPTIMUM TREATMENT OF MELTS OF WROUGHT ALUMINUM ALLOYS. Csak, J.; Vorsatz, B.; Szabo, L.; Zemplen-Papp, E. Banyasz. Kohasz. Lapok, Kohasz.; 106: No. 7, 323-333(Jul 1973). (In Hungarian).

Various methods of O determination in oxides were evaluated with particular reference to their application in the determination of the optimum treatment of molten Al alloys. Using the neutron-activation methods, the change of impurity level, and the gas/oxide relationship during the treatment were monitored, and from the results the optimum treatment was selected. (Metals Abstr.)

15905 CHEMICAL-INSTRUMENTAL NEUTRON-ACTIVATION ANALYSIS OF HIGH-PURITY LEAD AND BISMUTH. Levkovskii, V. N.; Artem'ev, O. I.; Kovel'skaya, G. E. (Inst. of Nuclear Physics, Alma-Ata, USSR). Zh. Anal. Khim.; 29: No. 11, 2199-2208(Nov 1974). (In Russian).

A procedure was developed for activation analysis of high purity lead and bismuth, which involves chemical removal of main radioactive elements followed by instrumental analysis of concentrates of impurities using a semiconductor γ spectrometer. Contents were determined or upper content limits were estimated for 29 elements as impurities in superhigh purity lead and of 7 elements in superhigh purity bismuth. (auth)

15906 RADIOACTIVATION DETERMINATION OF MERCURY IN SAMPLES TREATED WITH GRANOZAN. Gofen, G. I.; Kist, A. A.; Khatamov, Sh. (Inst. of Nuclear Physics, Tashkent). Zh. Anal. Khim.; 29: No. 11, 2194-2198(Nov 1974). (In Russian).

An instrumental procedure has been worked out of determining mercury in seed samples treated with mercury-containing pesticides. The sensitivity of determining mercury is 10^{-7}%. The results have been compared with those obtained by using radiochemical separation. An express radiochemical procedure of separation of mercury has been developed to ensure a better selectivity. The sensitivity is $2 \cdot 10^{-9}$%. Possibilities of the procedure have been appreciated in routine analysis. (auth)

15907 RADIOACTIVATION DETERMINATION OF THE NOBLE METALS IN NATURAL AND COMMERCIAL MATERIALS (A REVIEW). Rakovskii, E. E.; Krylova, T. D.; Baevskaya, G. M. (Central Scientific-Research Geological Prospecting Inst. of Non-Ferrous and Noble Metals, Moscow). Zh. Anal. Khim.; 29: No. 11, 2166-2171(Nov 1974). (In Russian).

Various procedures are discussed of radioactivation determination of the noble metals in some natural and commercial products. (81 references) (auth)

15908 RADIOACTIVATION DETERMINATION OF RUTHENIUM AND OSMIUM BY USING PRELIMINARY CONCENTRATION. Razhdaev, V. P.; Nikitin, V. N. (Leningrad Technological Inst.). Zh. Anal. Khim.; 29: No. 11, 2172-2175(Nov 1974). (In Russian).

The effect of rhodium (as collector) on concentration of ruthenium and osmium with thiourea was studied. In the presence of 1 mg of rhodium and activated charcoal, ruthenium and osmium were isolated from the samples to the extent of more than 90%. A procedure was developed for high-sensitivity determination of ruthenium and osmium in sulfate concentrates ($2 \cdot 10^{-6}$% Ru, $5 \cdot 10^{-7}$% Os). The possibility was shown of selective quantitative isolation of ruthenium and osmium by extraction of their tetraoxides into toluene and carbon tetrachloride. (auth)

15909 APPLICABILITY OF THE Pu–Be, Po–Be, AND ^{252}Cf LABORATORY NEUTRON SOURCES IN ACTIVATION ANALYSIS. Jozsa, I.; Peto, G.; Csikai, G.; Vinh Long, K. D. ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 339-349(1974). (In Hungarian).

Cross section averaged for the spectrum of Pu–Be and ^{252}Cf neutron sources were determined for 19 as well as for 21 different reactions in non-scattering geometry. On the basis of the obtained data the sensitivity for determination of Al, Ti, Cu, As, Sr, Mo, In, Cd, Ba, Au, Hg, and Pb was calculated under the present experimental conditions. (auth)

15910 MERCURY IN THE HUMAN BRAIN. Olszewski, W. A.; Pillay, K. K. S.; Glomski, C. A.; Brody, H. (Buffalo General Hospital). Acta Neurol. Scand.; 50: 581-588(1974).

A recently developed technique of neutron activation analysis permitted a sensitive analysis of mercury in over 160 samples of fresh brain tissue from 17 randomly selected autopsies. There was a preferential deposition of mercury in various anatomical loci. Many of these loci are those clinically or histologically affected in poisoning by methyl mercury. The greatest concentration of the metal was generally present in the cerebellum with a mean of 0.28 μg/g (parts per million). Forty per cent of the cerebellums had concentrations greater than 0.2 ppM. The visual cortex, pons and geniculate bodies contained levels averaging 0.17 to 0.20 ppM. The lowest levels were found in the frontal lobe white matter (mean 0.07 ppM). Two brains from patients with no exceptional exposure to environmental mercury had unusually elevated levels of 1 to 2 ppM in many regions. (DG)

15911 SIMULTANEOUS DETERMINATION OF CHROMIUM AND SILICON IN STEEL BY 14-MeV NEUTRON ACTIVATION ANALYSIS. Vandecasteele, C.; van Grieken, R.; Hoste, J. (Univ., Ghent). Anal. Chim. Acta; 72: No. 1, 31-36(Sep 1974).

Chromium and silicon were determined simultaneously in steel by 14-MeV neutron activation analysis. The activities of ^{52}V (E = 1.43 MeV, $T_{½}$ = 3.76 min) from ^{52}Cr(n,p)^{52}V and ^{28}Al (E = 1.78 MeV; $T_{½}$ = 2.24 min) from ^{28}Si(n,p)^{28}Al were evaluated by mixed gamma spectrometry. The influence of manganese and phosphorus, the main interfering elements, is negligible for most stainless steels. The count rate should be limited, to avoid ^{52}V pulse pile-up effects interfering in the ^{28}Al energy region. Precisions in the 2 to 10% range are reached, depending on the concentrations, for a 10-min analysis time. Results for a series of steel samples are compared with industrial analyses. (NL)

15912 DEVELOPMENT OF A FACILITY FOR PARTIAL BODY IN VIVO ACTIVATION ANALYSIS USING CALIFORNIUM-252 NEUTRON SOURCES. Boddy, K.; Robertson, I.; Glaros, D. (Scottish Research Reactor Centre, East Kolbride, Eng.). Phys. Med. Biol.; 19: No. 6, 853-861(Nov 1974).

Consideration of the nuclear and physical properties of ^{252}Cf, which is spontaneously fissile, suggested that it is a very suitable radioisotopic source of neutrons for partial-body in vivo activation analysis. A facility is described, which has been developed for use in the clinical environment, and is both simple in construction and operation and economical. The performance in the measurement of intrathyroidal iodine and of calcium in various bones, including the vertebrae, was evaluated with respect to uniformity of activation, sensitivity, reproducibility (precision) and dosimetry. The findings suggested that this technique will be suitable for clinical measurements in the hospital. (auth)

15913 DEVELOPMENT OF ACTIVATION ANALYSIS AT THE NUCLEAR RESEARCH INSTITUTE. Kukula, F. Nukleon; No. 4, 15-19(Dec 1973). (In Czech).

The development of neutron activation analysis and its applications at the Institute of Nuclear Research in Rez are discussed. (INIS)

15914 DETERMINATION OF VANADIUM IN PETROLEUM AND RELATED PRODUCTS BY ACTIVATION ANALYSIS. Passaglia, A. M.; Lima, F. W. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Radioquimica). Rev. Brasil. Tecnol.; 4: No. 1, 31-39(Mar 1973). (In Portuguese).

Based in part upon a thesis submitted by A. M. Passaglia to the Sao Paulo Univ., in partial fulfillment of the requirement for the M.Sc. degree.

Vanadium at level of parts per million, in petroleum, petroleum fractions, and in silica alumina cracking catalyst, was determined by activation analysis. Instrumental determination of vanadium in petroleum was made after 15 seconds of irradiation and the activity of vanadium-52 was measured by means of a NaI(Tl) scintillation detector coupled to a 400 channels analyzer. Vanadium in petroleum fractions was also determined using instrumental reactor-neutron activation analysis. Counting was performed by means of a high resolution Ge−Li gamma spectrometer coupled to an analyzer. The irradiation time was 5 minutes. In the case of determination of vanadium in cracking catalyst a pre-irradiation treatment of the catalyst by fusion with a mixture sodium and potassium carbonate was necessary. Radiochemical separation of vanadium, after irradiation, was made by solvent extraction. For all irradiations a thermal neutron flux of about 5×10^{12} n/cm$^2 \cdot$ s was used. According to the results obtained, the analytical method of neutron activation for vanadium in petroleum and distillation products, as well as in cracking catalyst, is a method specific, sensitive, precise and adequate for routine analysis. (INIS)

15915 ACTIVATION ANALYSIS OF MERCURY IN FILMS OF AMORPHOUS SELENIUM BY USE OF A TOROIDAL BETA SPECTROMETER. Solodukhin, V. P.; Sokol'skii, V. V.; Kazachevskii, I. V.; Smetannikov, V. V. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 4, 81-83(1974). (In Russian).

A method is described for the determination of Hg in films of amorphous Se from the 77 L and 77 M conversion lines of ^{197}Hg. The irradiation was carried out for 20 to 50 hrs in storage channel of the WWR-K reactor in a flux of 5×10^{12} n/cm^2 sec. The standards were prepared by the method of internal electrolysis. The sensitivity limit of the method is 5×10^{-8} g Hg. (tr-auth)

15916 BIOASSAY TECHNIQUES AND ENVIRONMENTAL CHEMSITRY. Glass, G. E. (ed.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1973). 506p.

The five sections include discussions on: an illustration of environmental complexities; uses of bioassay, general principles emphasized; examples of end points and indicators used in bioassay; conditions and supporting techniques for bioassay; and applications. A study on the determination of trace elements in water and aquatic biota by neutron activation analysis is abstracted and indexed separately for NSA. (TSS)

For an abstract of an individual section see: 15917.

15917 DETERMINATION OF TRACE ELEMENTS IN WATER AND AQUATIC BIOTA BY NEUTRON ACTIVATION ANALYSIS. Thatcher, L. L.; Johnson, J. O. (Geological Survey, Denver). pp 277-298 of Bioassay Techniques and Environmental Chemistry. Glass, G. E. (ed.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1973).

Advantages offered by neutron activation for water pollution analysis include positive identification of elements, high sensitivity, elimination of contamination from reagents, and minimization of exchange between the water sample and container. The latter point results from a special sampling procedure using a pre-analyzed polyethylene bag. Quartz ampoules are also used. Both containers eliminate transfer of sample prior to irradiation. Mercury was determined by a post-irradiation carrier precipitation. Fourteen other elements were determined by a post-irradiation mixed carrier hydroxide−sulfide precipitation. Cadmium, chromium, copper, zinc, arsenic and antimony are included. Rare earths were detected in many water samples. Even with radiochemistry, it is essential to use a high resolution lithium-drifted germanium detector to eliminate rare earth interference. The principal disadvantage of the method is failure to determine lead by the outlined procedure. (auth)

15918 SIMULTANEOUS DETERMINATION OF CARBON AND OXYGEN IN SEMICONDUCTOR SILICON BY HELIUM-3 ACTIVATION ANALYSIS. Vandecasteele, C.; Adams, F.; Hoste, J. (Univ., Ghent). Anal. Chim. Acta; 72: No. 2, 269-274(Oct 1974).

A nondestructive method for the simultaneous determination of carbon and oxygen in silicon by helium-3 activation analysis is described. The determination is based on a simplified standardization method. The method was applied to samples containing 0.05−3 p.p.m. of carbon and 0.05−10 p.p.m. of oxygen. The determination limit of carbon varies from 30 to 300 p.p.b. depending on the oxygen concentration. (auth)

15919 RADIOACTIVATION ANALYSIS AT THE BORIS KIDRIC INSTITUTE, VICA, AND THE POSSIBILITIES OF ITS APPLICATION. IV. Draskovic, R.; Ratkovic, M. (Boris Kidric Inst. of Nuclear Science, Belgrade). Tehnika (Belgrade); 27: No. 11, 276b-276d(1973).

The content of the trace elements in some organic compounds, such as rose bengal, hippuran and HSA, and their ^{131}I-labelled compounds, produced at the Boris Kidrič Institute at Vinča for diagnostic application in nuclear-medical centres in Yugoslavia, was investigated by nondestructive radioactivation analysis. (Bull. Sci. Sect. A)

15920 RADIOACTIVATION ANALYSIS AT THE BORIS KIDRIC INSTITUTE OF NUCLEAR SCIENCES AT VINCA, AND THE POSSIBILITIES OF ITS APPLICATION. III. Draskovic, R.; Slavic, I.; Tasovac, T.; Radosavljevic, R. (Boris Kidric Inst. of Nuclear Science, Belgrade). Tehnika (Belgrade); 27: No. 5, 139-142(1973).

Some results of the investigation of environmental aquatic systems by nondestructive radioactivation analysis are presented. The concentrations of some of the microelements (Cr, Sb, Sc, Fe, Co, Na and La) in the components of the Danube river's system were determined. (Bull. Sci., Sect. A.)

15921 APPLICATIONS OF NUCLEAR SCIENCE IN CRIME INVESTIGATION. Guinn, V. P. (Univ. of California, Irvine). Annu. Rev. Nucl. Sci.; 24: 561-591(1974).

The high sensitivity of detection of high-flux neutron activation analysis for a large number of elements, the nondestructive nature of the instrumental form of the method, and the good measurement precisions and accuracies attainable with the method make it a potentially very powerful and useful tool in the field of scientific crime investigation. Very tiny evidence specimens can be analyzed effectively, and numerous characterizing trace elements can be detected and measured in evidence specimens to facilitate their comparison as to probability of common origin. Crime investigation laboratories in several countries of the world are now using the method quite regularly in cases of selected types. The most fully developed applications of the method thus far are in the detection of gunshot residues, and in the comparison of evidence specimens of paint, hair, glass, and bullet lead, although much more development work is needed in even these areas of application. The advent of the Ge(Li) detector has increased the power of the FAA method even further, as has the development of good statistical methods for the proper interpretation of FAA data. (auth)

15922 USE OF MONITORS IN GAMMA-ACTIVATION ANALYSIS OF SHORT-LIVED ISOMERS. Vaivads, Ya. K.; Palkis, L. L. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 5, 8-12(1974). (In Russian).

Gamma-activation analysis errors due to the use of monitors in the analysis of short-lived isomers are considered. Mathematical expressions are given for the correction coefficients, the errors are analyzed depending on the half-life of the monitors employed. Hafnium (^{179m}Hf), or selenium (^{77m}Se) are found to be good monitors for the case of gamma-activation determination of Y by reaction ^{89}Y (γ,γ') ^{89m}Y. (auth)

15923 DETERMINATION OF Y AND In AND SOME RARE-EARTH ELEMENTS IN GARNETS BY (γ,γ') REACTION IN A LINEAR ELECTRON ACCELERATOR. Vaivads, Ya. K.; Pelkis, L. L. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 5, 3-7(1974). (In Russian).

Methods are developed for the determination of yttrium by ^{89m}Y obtained in (γ,γ') reaction on γ-quanta of the linac bremsstrahlung. HfO_2 pellets have been used as a monitor. The induced activities of the (^{89m}Y) sample and the (^{179m}Hf) monitor have been measured simultaneously with a gamma spectrometer. Methods for the determination of In, Er and Lu are discussed. The thresholds of detectability with electron current 0.7 ma and energy 4 MeV are 1.2 mg Y, 0.07 mg In, 0.1 mg Er and 0.8 mg Lu. (auth)

15924 INSTRUMENTAL MULTICOMPONENT NEUTRON ACTIVATION ANALYSIS OF PLANT MATERIAL. Dubinskaya, N. A.; Kyun'ke, L. M. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 5, 13-21(1974). (In Russian).

Application possibilities of the analysis by utilizing the gamma spectrometry of high resolution were studied. At different regimes of the analysis 40 radioisotopes were identified in various parts of haricot, wheat and barley. Preferable γ-lines for a quantitative analysis were found, taking into account possible spectral interference. (auth)

15925 QUANTITATIVE ANALYSIS OF SELENIUM IN SOUND HUMAN ENAMEL BY NEUTRON ACTIVATION ANALYSIS. Retief, D. H. (Atomic Energy Board, Pelindaba, Pretoria); Scanes, S.; Cleaton-Jones, P. E.; Turkstra, J.; Smit, H. J. Arch. Oral Biol.; 19: No. 7, 517-523(Jul 1974).

Epidemiological studies have shown a positive association between selenium intake and dental caries. The purpose of this study was to determine quantitatively the selenium content of normal human enamel in a racial group with low caries prevalence. Each enamel sample was simultaneously irradiated with a reference standard containing 1 μg of selenium. The irradiations were made for three weeks in a nuclear reactor in a thermal neutron flux of 2×10^{13} n cm^{-2} sec^{-1}. After a cooling period of 3 weeks, these samples were dissolved and quantitatively transferred, with selenium carrier, to a distillation apparatus. A selective distillation was carried out and each distillate was made up to 25 ml and transferred to a standard plastic container. The γ-ray activity of ^{75}Se was measured with a 50-cm^3 coaxial Ge(Li) detector coupled to a fully transistorized 4000-channel analyzer. The data were recorded on magnetic tape and afterwards computer-processed. The distillation technique gave a 98% yield of selenium, which makes the method experimentally acceptable. The selenium content of the composite enamel samples was 0.08 ± 0.03 ppM. (auth)

15926 MEASUREMENT OF WHOLE-BODY NITROGEN BY PULSED NEUTRON ACTIVATION ANALYSIS. Chamberlain, M. J.; Fremlin, J. H. (Univ. of Birmingham, Eng.). pp 88-93 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A system was devised for whole and partial (i.e. individual organ) pulsed neutron activation analysis for measurement of whole-body nitrogen content. The patient lies on a moving bed and passes through a pulsed neutron beam which is vertically directed. The neutrons are produced by the action of cyclotron protons on a lithium target and pass through a 3 meter concrete collimator lined with steel and LiF doped polyester. The cyclotron is pulsed so that the patient receives 20 μ second neutron pulses approximately 2300 times per second. The induced activity is viewed by shielded sodium iodide and lithium/germanium detectors outside the neutron beam. Activity is recorded and analyzed on line in the intervals between activating neutron pulses. The system was designed with the measurement of whole-body nitrogen particularly in mind with detection of the prompt gamma emission at 10.8 MeV after the slow neutron reaction ^{14}N$(n,\gamma)^{15}$N. Phantoms and cadaver studies showed that total-body nitrogen might be measured to an accuracy of ±1–2% for a whole body radiation dose of 0.1 rem. Measurements of body nitrogen and particularly sequential measurements have numerous applications in the field of protein metabolism and nutritional studies. They might replace the conventional nitrogen balance. (auth)

15927 DETERMINATION OF BODY CALCIUM BY NEUTRON ACTIVATION: STUDY OF EXPERIMENTAL PARAMETERS. Guey, A.; Tousset, G.; Manin, J. P. (Institut de Physique Nucleaire, Lyon). pp 376-388 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A series of measurements of the calcium content of a phantom by neutron activation analysis is presented. The phantom weighed 85 kg and had a length of 177 cm. It was found possible to obtain quantitative measurements of the following parameters: dose absorbed from the incident neutron beam, homogeneity of the neutron flux in the target, efficiency of detection in simulated conditions of an in vivo irradiation. A synchrocyclotron was used for this work and incident deuterons were chosen in an energy region of 10 to 28 MeV. Detection of radiocalcium (^{49}Ca) produced by the irradiation permitted quantitative measurements of total calcium mass. (auth)

15928 INORGANIC COMPOSITION OF BELGIAN COALS AND COAL ASHES. Block, C.; Dams, R. (Rijksuniversiteit, Ghent). Environ. Sci. Technol.; 9: No. 2, 146-150(Feb 1975).

Coal and coal ash samples, 48 and 20, respectively, have been analyzed for 44 elements using a combination of activation analysis with thermal and 14-MeV neutrons. Composition balances of the ash samples give totals varying from 97.5-103%. Concentrations of most elements vary strongly between samples. These concentration differences are much reduced by classification of the coals according to their use or according to their ash content. The elements determined are divided in two groups, namely the oxyphilic or lithophilic elements and the sulfophilic elements. The first group is present in concentration ratios close to crustal rock and in nearly constant concentrations in the ash. The elements of the second group are strongly enriched in coal ash with regard to the composition of crustal rock, and their concentrations in the coal are independent of the ash contents. Low-ash coals produce fly ash with larger concentrations of the sulfophilic elements than high-ash coals. In addition, the halogens, Hg, Se, As, and Sb, are preferentially volatilized during combustion. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 16510, 16678, 19140, and 19146.

15929 (LA-5791) FLAMELESS ATOMIC ABSORPTION APPARATUS FOR ANALYZING ALPHA-RADIOACTIVE MATERIALS. Cox, L. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 6p. Dep. NTIS $4.00.

A flameless atomic absorption instrument was developed that analyzes trace impurities in uranium and plutonium with greater precision and accuracy than are obtained by carrier distillation emission spectroscopy methods. The apparatus includes a sequencer that provides drying, charring, and atomizing periods of preselected duration, and an analog integrator that automatically corrects baseline drift. The electronic components are placed outside a glovebox to prevent exposure to radioactivity. Typical relative standard deviations for aluminum, chromium, copper, iron, and nickel are 3 to 6%. Average biases for recovering elements from plutonium solutions range from 5 to 9%. (auth)

15930 (LYCEN-7432) SEPARATION OF GOLD AND PALLADIUM TRACES IN COPPER. Substoichiometric Determination of Palladium. Montes, H. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). 1974. 58p. (In French). Dep. NTIS (US Sales Only) $6.00.

Thesis.

The increasing demand for rare metals, and their high prices, have given rise to a growing interest for the working of low proportion ores. After reviewing the different analytical methods used for the determination of such trace analysis, the substoichiometric isotope dilution analysis with solvent extraction was selected. First, the separation and determination of gold and palladium traces in copper (between 100 and 10 μg/g) was studied. A theoretical approach leads to use the diethyldithiocarbamate as a chelating reagent. When both elements are present it is necessary to make a preliminary separation and this is achieved by solvent extraction of chloraurlc acid and palladium II bisdimethylglyoximate. Due to the stability of reagents and the kinetics of reactions, palladium was determined. The scattering of results may be compared to those obtained for atomic absorption, x-fluorescence, and activation analysis, but this method has the advantage of being simpler. (FR)

15931 (RCN-215) DETERMINATION OF METALLIC IMPURITIES IN METALLIC SODIUM BY MEANS OF EMISSION SPECTROGRAPHY. van Raaphorst, J. G.; Ordelman, J.; Tolk, A. (Stichting Reactor Centrum Nederland, The Hague). Oct 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

A procedure is presented for the determination of metallic impurities in metallic sodium. The sodium (4 gs) is mixed with ultrapure graphite powder (1 g) at 100°C. Then the sodium is distilled from the crucible at 360°C under vacuum during half an hour. The impurities remain behind in the graphite. The graphite is mixed with lithim fluoride in such a way that a final mixture of 88% graphite and 12% lithium fluoride is obtained. From this mixture cylindrical pellets are pressed which fit exactly into the sample electrode. Then an emission spectrogram of the sample is taken by means of a dc arc of about 10 amperes; photographic registration is used. Detection limits are in the range of about 0.05 to 1 ppM. (auth)

15932 (RFP-2287) DETERMINATION OF SUBMICROGRAM AMOUNTS OF BERYLLIUM IN AIR FILTER SAMPLES BY NON-FLAME ATOMIC ABSORPTION SPECTROMETRY. Hurlbut, J. A.; Bokowski, D. L. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 31 Dec 1974. Contract AT(29-1)-1106. 10p. Dep. NTIS $4.00.

A routine method of analysis for nanogram amounts of beryllium collected on air filters is described. A filter is ashed in oxidizing acids, diluted with sulfuric acid (H_2SO_4) and water, and analyzed with a single-beam, nonflame atomic absorption spectrometer. Aqueous standards containing 0.9M H_2SO_4 are used; the sensitivity and detection limits are 1.0×10^{-12} g and 0.4×10^{-12} g respectively. Four nanograms of beryllium per paper filter are recoverable with a relative accuracy of ±5% and a relative standard deviation of ±8%. The aluminum in glass filters causes a nonatomic absorption peak that interferes with the beryllium atomic absorption peak. As a result, the detection is limited to about 0.1 μg of beryllium per glass filter. Perchloric acid ($HClO_4$) and hydrofluoric acid (HF) also interfere with the absorption signal and have to be removed during digestion. (auth)

15933 USE OF PAPER DISTRIBUTION CHROMATOGRAPHY FOR DETERMINATION OF RUTHENIUM AND OSMIUM IN MINERAL RAW MATERIALS. Razina, I. S.; Viktorova, M. E. (Inst. of Mineralogy, Geochemistry, and Crystallochemistry of Rare Elements, Moscow). Zh. Anal. Khim.; 29: No. 11, 2254-2256 (Nov 1974). (In Russian).

A procedure is suggested for chromatographic separation and determination of ruthenium and osmium in mineral raw materials. The sensitivity is (1 to 3) $\cdot 10^{-5}$%, the relative error is not greater than ±17%. The possibility was shown of a double increase in the sensitivity of determining osmium and ruthenium with thiourea after evaporation of their ethanol hydrochloric acid solutions. (auth)

15934 CHEMILUMINESCENCE METHODS OF DETERMINING GOLD, SILVER, OSMIUM, AND RUTHENIUM BY MEANS OF LUMINOL. Lukovskaya, N. M.; Terletskaya, A. V.; Bogoslovskaya, T. A. (Inst. of General and Inorganic Chemistry, Kiev). Zh. Anal. Khim.; 29: No. 11, 2268-2270(Nov 1974). (In Russian).

Some reactions were found and examined of chemiluminescence determination of gold, silver, osmium, and ruthenium with luminol. Procedures were developed of determining the elements with a sensitivity of 10^{-2} μg Au(III), 10^{-2} μg Ag(I), $2 \cdot 10^{-4}$ μg Os(VIII, VI), $2 \cdot 10^{-3}$ μg Os(IV), $4 \cdot 10^{-4}$ μg Ru(III, VI), $1 \cdot 10^{-3}$ μg Ru(VI) from a final volume 1 ml. (auth)

15935 DETERMINATION OF MICROAMOUNTS OF THE NOBLE METALS IN TECHNOLOGICAL SOLUTIONS. Karpova, A. F.; Litvinskaya, I. I.; Kashlinskaya, S. E.; Khardina, V. K.; Kunilova, N. M. (Leningrad Technological Inst.). Zh. Anal. Khim.; 29: No. 11, 2279-2281(Nov 1974). (In Russian).

A procedure is suggested of chemical-spectrographic determination of the noble metals and gold in solutions of copper and nickel production. The procedure ensures a high sensitivity; it is rapid. Optimal conditions have been chosen for sorption of the platinum group metals on a fiber. Two variants of spectrographic determination are suggested to extend concentration limits for the elements to be determined and to control the results obtained. (auth)

15936 DETERMINATION OF TELLURIUM BY BISMUTHOL-2 IN THE PRESENCE OF CADMIUM BY USING PAPER PEAK CHROMATOGRAPHY. Pasechnova, R. A.; Mokhov, A. A.; Yudin, B. F. (Leningrad Technological Inst.). Zh. Anal. Khim.; 29: No. 11, 2292-2295(Nov 1974). (In Russian).

A chromatographic procedure was developed of determining microamounts of tellurium from the peak heights on paper impregnated with bismuthol-2. The detection limit is 0.15 μg Te. The tellurium peaks are equally well formed from sulfuric, nitric, and hydrochloric acid media over a wide acidity range. The procedure makes it possible to determine tellurium in the presence of cadmium with a relative error of less than 2%. (auth)

15937 SOLVENT EXTRACTION OF THE PLATINUM GROUP ELEMENTS WITH DIPHENYLDITHIOPHOSPHINIC ACID. Kabanova, L. K.; Usova, S. V. (Inst. of Geology, Dushanbe, USSR). Zh. Anal. Khim.; 29: No. 11, 2248-2249(Nov 1974). (In Russian).

The possibility was shown of using diphenyldithiophosphinic acid as a reagent for determining the platinum group metals. Optimal conditions were found for the extraction of Ru, Rh, Os, and Pt. Extraction-photometric procedures were developed for determining Ru, Rh, and Os. (auth)

15938 COMPLEX FORMATION OF URANIUM(VI) WITH 1,5-di-(2-HYDROXY-5-SULFOPHENYL)-3-CYANOFORMAZANE. Sergovskaya, B. B.; Ermakova, M. I.; Onosova, S. P. (Ural Polytechnic Inst., Sverdlovsk, USSR). Zh. Anal. Khim.; 29: No. 11, 2216-2224(Nov 1974). (In Russian).

Complex formation was studied of U(VI) with 1,5-di-(2-hydroxy-5-sulfophenyl)-3-cyanphormazane. The metal-to-reagent ratio in the complex formed is 1 : 1, the optimal pH range being 5.0–5.5. The absorption maximum is located at 630–640 nm ($\epsilon_{640} = 1.63 \cdot 10^4$). The equilibrium constant for the complex formation reaction is $1.77 \cdot 10^{-6}$, the instability constant for the complex $1.05 \cdot 10^{-21}$. A procedure was developed for direct spectrophotometric determination of uranium(VI) in the presence of 3000 times its amount of thorium. (auth)

15939 X-RAY-SPECTRAL DETERMINATION OF THE NOBLE METALS IN SLIMES AND PLATINUM CONCENTRATES. Shestakov, V. A.; Arkhipov, N. A.; Makarov, D. F.; Kukushkin, Yu. N. (Leningrad Technological Inst.). Zh. Anal. Khim.; 29: No. 11, 2176-2180(Nov 1974). (In Russian).

A procedure has been developed of express x-ray-spectral determination of Pd, Pt, Rh, Ru, Au, and Ag in slimes and platinum concentrates. The procedure accuracy is not worse than that of chemical methods while the analysis time is reduced by 5 times. A procedure of determining iridium has been tested involving concentration of iridium into a silver bead followed by dissolution of the alloy and x-ray-spectral analysis of the insoluble residue. The precision of determining iridium is ±10%. (auth)

15940 USE OF NICKEL MATTE AS A COLLECTOR FOR THE NOBLE METALS IN ANALYSIS OF POOR MATERIALS. Kuznetsov, A. P.; Kukushkin, Yu. N.; Makarov, D. F. (Leningrad Technological Inst.). Zh. Anal. Khim.; 29: No. 11, 2155-2160(Nov 1974). (In Russian).

It is suggested to use nickel matte as a collector for concentration of the noble metals. A simple method is suggested of fire-chemical concentration of the metals from some commercial and natural materials by using the collector. The maximum concentration factor can be as high as 1000. A procedure has been worked out of analysis of nickel matte for the contents of 8 noble metals by the atomic-absorption and spectrographic methods. (auth)

15941 DETERMINATION OF THE PLATINUM METALS IN COPPER-BASED STANDARDS FOR SPECTROGRAPHIC ANALYSIS. Danilova, F. I.; Orobinskaya, V. A.; Parfenova, V. S.; Propistsova, R. F.; Savvin, S. B. (Siberian State Design and Scientific-Research Inst. of Non-Ferrous Metallurgy, Krasnoyarsk, USSR). Zh. Anal. Khim.; 29: No. 11, 2150-2154(Nov 1974). (In Russian).

A procedure is suggested of determining microconcentrations of Pt, Pd, Rh, Ru, Au, and Ag in copper-based standards by using selective organic reagents. The coefficient of variation is 1.2–

6.5% in the determination of Pt, Pd, Rh, Au, Ag, and Ru and 10.2% in the determination of Ir. (auth)

15942 CHEMICAL-SPECTRAL DETERMINATION OF THE PLATINUM GROUP METALS AND GOLD IN PRODUCTS OF SULFIDE COPPER-NICKEL ORE PROCESSING. Tarasova, I. I.; Dudenkova, L. S.; Khitrov, V. G.; Belousov, G. E. (Mining and Metallurgical Group of Enterprises, Moscow). Zh. Anal. Khim.; 29: No. 11, 2147-2149(Nov 1974). (In Russian).

The chemical-spectral method of determining the platinum group metals in products of autoclave processing sulfide copper-nickel ores is reliable enough and can be used for analysis of both dry products and technological solutions. Chemical preparation of the samples is simple, and spectral determination by means of a semiautomatic device AI-3 ensures necessary sensitivity when 1-5 g samples are used. The determination of all the elements in 12-16 samples takes 5 shifts. The method is recommended to control the contents of the platinum metals. (auth)

15943 CHEMICAL-SPECTROGRAPHIC DETERMINATION OF THE PLATINUM METALS AND GOLD IN COPPER-NICKEL ALLOYS OBTAINED BY SMELTING COPPER-NICKEL ORES. Danilova, F. I.; Orobinskaya, V. A.; Parfenova, V. S.; Nazarenko, R. M.; Khitrov, V. G.; Belousov, G. E. (Siberian State Design and Scientific-Research Inst. of Non-Ferrous Metallurgy, Krasnoyarsk, USSR). Zh. Anal. Khim.; 29: No. 11, 2142-2146(Nov 1974). (In Russian).

A procedure was developed of chemical-spectrographic determination of Pt, Pd, Rh, Ir, Ru, and Au in copper-nickel alloys obtained by smelting ores and other commercial materials and of Pt, Pd, Rh, and Au directly in ores. The coefficient of variation is 7 to 15%. The procedure makes it possible to control the element contents in poor materials. The analysis takes 3 to 5 days. (auth)

15944 DETERMINATION OF IMPURITIES IN PURE SILVER BY ATOMIC ABSORPTION SPECTROPHOTOMETRY. Khrapai, V. P.; Startseva, E. A.; Zhuravleva, L. E.; Popova, N. M. Zh. Anal. Khim.; 29: No. 11, 2137-2141(Nov 1974). (In Russian).

A procedure was worked out of atomic-absorption determination of Pd, Pt, Te, Cu, Fe, Rh, Bi, Ni, Co, Pb, Se, Cr, Mn, In, Zn in pure silver after extraction concentration. Silver is separated by extraction with tertiary dodecylmercaptane. Palladium is determined in the organic phase after extraction separation with dioctylsulfoxide. Te, Se, Bi, In, Zn, and Cu are determined in extracts obtained by using dibutylthiophosphoric acid. To omit the effect of accompanied impurities during determination of platinum and rhodium, it is recommended to use cadmium and vanadium(IV) sulfates and cadmium nitrate as buffer additives. The coefficients of variation for determining the impurities are 2-8%. (auth)

15945 BUFFER PROPERTIES OF SODIUM, CADMIUM, COPPER, AND LANTHANUM SULFATE SOLUTIONS IN ATOMIC ABSORPTION DETERMINATION OF RUTHENIUM, IRIDIUM, AND RHODIUM IN SOLUTIONS OF COMPLEX COMPOSITION. Makarov, D. F.; Kukushkin, Yu. N.; Eroshevich, T. A. (Leningrad Technological Inst.). Zh. Anal. Khim.; 29: No. 11, 2128-2131(Nov 1974). (In Russian).

Buffer properties have been examined of copper, sodium, cadmium, and lanthanum sulfate solutions in determination of rhodium, ruthenium, and iridium in solutions of complex composition. A mixture of copper and cadmium sulfates (5 mg Cu/ml and 5 mg Cd/ml) is suggested for determination of platinum, ruthenium, and iridium in solutions of complex composition. A buffer solution of lanthanum sulfate (5 mg La/ml) is suggested for determination of rhodium in solutions of complex composition. (auth)

15946 DETERMINATION OF THE PLATINUM METALS, GOLD, AND SILVER BY ATOMIC-ABSORPTION SPECTROPHOTOMETRY (A REVIEW). Fishkova, N. L. (Central Scientific-Research Geological Prospecting Inst. of Non-Ferrous and Noble Metals, Moscow). Zh. Anal. Khim.; 29: No. 11, 2121-2127(Nov 1974). (In Russian).

Possible applications of atomic-absorption spectrophotometry to determination of the platinum group metals, gold, and silver in various materials are discussed. (126 references) (auth)

15947 MICROGRAVIMETRIC DETERMINATION OF OSMIUM AND RUTHENIUM BY MEANS OF 2-MERCAPTOBENZIMIDAZOLE, 2-MERCAPTOBENZOXAZOLE, AND 2-MERCAPTOBENZOTHIAZOLE. Busev, A. I.; Lomakina, L. N.; Ignat'eva, T. I.; Leskova, L. I. (Moscow State Univ.). Zh. Anal. Khim.; 29: No. 11, 2117-2120(Nov 1974). (In Russian).

Compounds of osmium(VIII, IV) and ruthenium(IV) with 2-mercaptobenzimidazole, 2-mercaptobenzoxazol, and 2-mercaptobenzothiazol were studied in acetic acid media (pH 4 to 5.5). Procedures are suggested of microgravimetric determination of osmium and ruthenium by using these reagents. (auth)

15948 SPECTROPHOTOMETRIC DETERMINATION OF RUTHENIUM BY MEANS OF GLYCINE. Bukanova, A. E.; Prokof'eva, I. V.; Sidorova, T. P. (Inst. of General and Inorganic Chemistry, Moscow). Zh. Anal. Khim.; 29: No. 11, 2109-2111(Nov 1974). (In Russian).

A procedure is suggested of spectrophotometric determination of ruthenium in the form of its compounds with glycine in solutions of chloride complexes of Ru(III) obtained by distilling off RuO_4 in the presence of sodium bromate and its absorption with 6 *M* HCl. Milligram and microgram amounts of ruthenium can be determined by measuring the optical density of the colored solutions respectively at 600 and 295 nm. (auth)

15949 DETERMINATION OF THE NOBLE METALS IN TECHNOLOGICAL PRODUCTS AND ORES OF NORILSK MINING AND METALLURGICAL GROUP OF ENTERPRISES. Pavlova, V. N.; Pak, M. N.; Prelovskii, S. A. Zh. Anal. Khim.; 29: No. 11, 2088-2093(Nov 1974). (In Russian).

Norilsk analysts have solved a problem of determination of all the noble metals in rich materials (total contents of the platinum metals 0.5%) and determination of platinum, palladium, rhodium, and gold in poor materials (ores, tailings, etc). The method used for determining ruthenium and osmium in poor materials is rapid enough, but its accuracy is insufficient. Instrumental methods of determining the noble metals are successfully introduced. (auth)

15950 CHEMICOSPECTRAL ANALYTIC METHOD OF HIGH-PURITY GOLD AS EXTRACTED BY DI-N-BUTYLSULFIDE. Nikolaev, A. V.; Yudelevich, I. G.; Vall, G. A.; Torgov, V. G. (Inst. of Inorganic Chemistry, Novosibirsk, USSR). Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk; No. 6, 93-97(Nov 1974). (In Russian).

A method of chemicospectral analysis of high-purity gold has been developed based on preliminary elimination of the matrix by extraction with dibutylsulfide (DBS) solution in chloroform, which allows determination of 26 microimpurities (Ag, Al, As, Bi, Be, Ca, Cd, Cr, Co, Cu, Ga, Ir, In, Fe, Mg, Mn, Ni, Rh, Ru, Pt, Pb, Sb, Sn, Te, W, Zn) in gold with detection limits of $2 \cdot 10^{-5}$ + $2 \cdot 10^{-6}$%. (auth)

15951 RE-EXTRACTION-AMPEROMETRIC TITRATION OF ACETYLACETONATE, IODIDE, AND NITRATE COMPLEXES OF METALS WITH COMPLEXON. III. Mukhamedzhanova, D.; Khadeev, V. A.; Talipov, Sh. T. (Tashkent State Univ.). Dokl. Akad. Nauk Uzb. SSR; No. 7, 37-38(1974). (In Russian).

The possibility of using reextraction-amperometric titrations for the extraction of acetylacetonate, iodide, and nitrate complexes of a series of metals was studied. Acetylacetonate complexes of Cu, In, Th, and Ga, iodide complexes of In, Bi, Cd, and Pb, and nitrate complexes of Th were investigated. The acetylacetonate complexes were extracted at a pH of 6 to 7 with a 1 to 0.5 M solution of acetylacetone in $CHCl_3$. The other complexes were extracted with cyclohexanone. Results showed that the lower limits of titratable concentration is approximately 10 to 20 μg in 10 ml of extract. (JSR)

15952 USE OF N,N′-DIPHENYLTHIOCARBAMYL-HYDROXAMIC ACID FOR AMPEROMETRIC DETERMINATION OF Mo(VI). Gallai, Z. A.; Sheina, N. M.; Polikarpova, N. V.; Ilyushina, A. M. Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 5, 582-584(1974). (In Russian).

The volt-ampere investigation of the oxidation process of N,N′-diphenylthiocarbamyl-hydroxamic acid was performed on the rotating graphite microelectrode in the 0.5 to 6.5 M H_2SO_4 solutions and the NH_4OH-CO_3COOH solutions with pH = 3 to 9.5. A method for the amperometric determination of molybdenum (VI) by N,N′-diphenylthiocarbamyl-hydroxamic acid on the rotating graphite microelectrode in sulfuric acid medium was worked out. Cobalt, nickel, aluminium, chromium (III), zinc, manganese (II), copper (II), iron (III), tungsten (VI), and lead were found not to effect the molybdenum determination. (auth)

15953 EFFECT OF ORGANIC SOLVENT NATURE ON FLUORESCENCE AND EXTRACTION OF RHODAMINE DYES AND THEIR IONIC ASSOCIATES WITH CHLOROTELLURITE. Golovina, A. P.; Savvina, L. P.; Runov, V. K.; Zorov, N. B.; Khvatkova, Z. M. Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 5, 577-581 (1974). (In Russian).

The effects of the organic solvent (ketones, alcohols, amines, dimethylformamide, ethylacetate, chloroform, tributyl phosphate, pyridine) on the fluorescence and extraction of rhodamine dyes

6G, 3GO, 3C, and their ionic associates with chlorotellurite were investigated. For the extractive fluorometric determination of tellurium with 6G and 3GO, small amounts of polar organic solvents (acetone, primary alcohols) should be added to benzene. In the case of rhodamine 3C the extraction by benzene may be performed without adding the polar organic solvents. The extraction of rhodamine dyes was assumed to depend on their ability to form the intermolecular hydrogen bond with the molecules of solvent. (auth)

15954 α-CARBOLINE DERIVATIVES AS REAGENTS FOR EXTRACTION: PHOTOMETRIC DETERMINATION OF Nb(V). Lobanov, F. I.; Zatonskaya, V. M.; Gibalo, I. M. Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 5, 569-573(1974). (In Russian).

The protonization constant of 2,3-dimethyl-α-carboline (DMC) was measured by solubility and distribution methods to be equal to 4.6 ± 0.2 and 4.3 ± 0.1, respectively. The protonization constant of 2-methyl-4-phenyl-α-carboline (MPC) was determined by a distribution technique to be equal to 0.6 ± 0.1. The formation of a colored mixed compound (ionic associates) of niobium thiocyanate with DMC and MPC, was established. The optimal conditions of formation of associates were as follows: 1M H_2SO_4, 0.4 to 0.6 M KCNS, 8.8×10^{-4} M DMC, and 1M H_2SO_4, 0.5 to 0.7 M KCNS, 10^{-3} M MPC. The extraction of associates by 2% solution of tributylphosphate (TBP) in benzene was studied. The extracts of these compounds were found to manifest the absorption maximum at 400 nm and $\epsilon = 3.5 \cdot 10^4$. The ratio of components in extracted associate was measured by equilibrium shift technique to be Nb : NCS : DMC : TBP = 1 : 3 : 1 : 1. The composition of the ionic associate was suggested to be: $[HDMC]^+[NbO(OH)(NCS)_3 \cdot H_2O \cdot TBP]^-$. The DMC compound was utilized to determine Nb in a ferroniobium alloy by the extraction–photometric technique. (auth)

15955 ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF THE PLATINUM METALS. Hrabikova, J.; Dolezal, J.; Zyka, J. (Charles Univ., Prague). Anal. Lett.; 7: No. 12, 819-825(Dec 1974).

The spectrophotometric behavior of the chlorocomplexes of ruthenium, osmium, and rhodium in the ultraviolet spectral region was studied and conditions for their determination found. (auth)

15956 SPECTROPHOTOMETRIC DETERMINATION OF THE GROUP OF RARE EARTHS IN VARIOUS TYPES OF ROCKS. Voldet, P. (Dept. de Mineralogie, Geneva); Haerdi, W. Anal. Chim. Acta; 72: No. 1, 111-119(Sep 1974). (In French).

The combined gravimetric-spectrophotometric method described by Jeffery was modified with regard to spectrophotometric determination with arsenazo-III. The modified procedure gives good precision for the rare earths in various types of rocks. A large variety of rocks was studied, hence a standard addition method was adopted to eliminate matrix effects. The lower limit of detection under the experimental conditions used was about 50 ppM. The results obtained were satisfactory for the purpose of obtaining an order of magnitude for the overall content of the rare earths in different types of rocks. (NL)

15957 COMPUTER RESOLUTION OF PLASMA CHROMATOGRAPHIC PEAKS. Karasek, F. W.; Laub, R. J.; De Decker, E. (Univ. of Waterloo, Ont.). J. Chromatogr.; 93: No. 1, 123-128(Jun 1974).

Used as a gas chromatographic detector, the plasma chromatograph produces low resolution positive and negative mobility spectra to identify chromatographed components. The negative plasma chromatographic mobility spectra obtained for chlorobenzene, bromobenzene, and iodobenzene give only Cl^-, Br^-, and I^- ionic species. Application of a deconvolution technique to the halide ion peaks gives resolution of the same number of components as isotopes present: two for the Cl^- and Br^-; one for the I^-. The areas of the Cl^- and Br^- deconvoluted components were approximately equal to the isotope abundances of these elements. Enhanced resolution by this technique increases qualitative data obtainable with the plasma chromatograph. (NL)

15958 DETERMINATION OF ZIRCONIUM CONTENT IN COMPLEX ALLOYS, PREFERABLY IN HIGH TEMPERATURE ALLOYS. Bohnstedt, U. Dew Tech. Ber.; 13: No. 3, 213-216 (Dec 1973). (In German).

High temperature alloys often contain substantial amounts of Ni, Co, Cr, W, Mo and smaller amounts of Al, Ti, B, and P. In determining Zr under these conditions, the colors developed with Arsenazo III after electrolysis on a Hg cathode are uncertain. Improved results, less liable to be affected by Ti in particular, are obtained by use of xylenol orange. Precipitation of Zr by phenylarsonic acid, to permit separation of interfering constituents, is recommended. Full details of the procedure by which Zr contents over about 0.001% can be determined in all technical alloys are given. Hf is determined with the Zr. (Metals Abstr.)

15959 DETERMINATION OF NIOBIUM AND TANTALUM IN ISOLATES OF HEAT-RESISTING NICKEL ALLOYS IN PRESENCE OF TUNGSTEN, TITANIUM, AND MOLYBDENUM, WITH PYROGALLOL. Preis, G. Dew Tech. Ber.; 13: No. 3, 217-222 (Dec 1973). (In German).

The procedure for the separate determination of Nb and Ta in the presence of W, Ti, and Mo in precipitates isolated from heat-resistant Ni-based superalloys is described. Nb does not influence the determination of Ta. Ta affects the Nb determination to a slight degree, and a correction is required when Ta contents are high. The elements W, Ti, and Mo give more or less intensely colored complexes, and the intensity of color is related linearly with concentration of elements. The use of these indirect methods has an unfavorable influence on the standard deviation and variance in relation to reproducibility. The reliability of the precipitation procedure is not called in question thereby. (Metals Abstr.)

15960 AUXILIARY COMPLEXING AGENTS IN THE DIFFERENTIAL COMPLEXIMETRIC TITRATION OF ZINC AND CADMIUM WITH THERMOMETRIC END-POINTS. Doi, K. (Nagoya Inst. of Tech., Japan); Tanaka, M. Anal. Chim. Acta; 71: No. 2, 464-467(1974).

15961 SURVEY OF THE BORON CONTENT OF CERTAIN WATERS OF THE GREATER LONDON AREA USING A NOVEL ANALYTICAL METHOD. Matthews, P. J. (Greater London Council). Water Res.; 8: No. 12, 1021-1028(Dec 1974).

Natural levels of boron, (as boric acid), in the aquatic environment have been raised artificially in certain areas by sewage effluents. Boron is present in sewage effluent by virtue of the use of sodium perborate as a whitener in washing powders. A novel analytical method based on the solvent extraction of ferroin borodisalicylate was used in a survey of various types of sewage, sewage effluent, and natural waters in the London area. The method was found to be satisfactory under all conditions. The data obtained will be useful in water resource planning and indicated that the concentration of boron in a watercourse may be used, under certain conditions, to determine the degree of dilution of sewage effluent in that watercourse. (auth)

15962 DETERMINATION OF SMALL AMOUNTS OF LEAD IN URANIUM. Stulikova, M.; Adam, J. (Karlova Univ., Prague). Talanta; 21: No. 11, 1203-1204(Nov 1974).

Small amounts of lead in the presence of large amounts of uranium can be determined by complexing the lead with nitrilotriacetic acid in aqueous solution at about pH 6 (adjusted with hexamine) and extracting the uranium into a chloroform solution of diphenylacetic acid. The aqueous phase is then acidified and the lead determined polarographically. (auth)

15963 QUANTITATIVE DETERMINATIONS OF TECHNETATE (VII) AND TECHNETIUM(IV). Mazzocchin, G. A.; Mazzi, U.; Portanova, R.; Traverso, O. (Consiglio Nazionale delle Ricerche, Padua). J. Inorg. Nucl. Chem.; 36: No. 12, 3783-3788(Dec 1974).

Volumetric titrations of technetium(IV) solutions with Ce(IV) have been performed with potentiometric, biamperometric and bipotentiometric detection of the equivalence point. Coulometric titrations of technetate(VII) solutions have been carried out with electrogenerated tin(II). Precipitation titrations of both Tc(VII) and Tc(IV) solutions have also been performed with tetraphenylarsonium and tetraphenylphosphonium chloride solutions and radiometric detection of the equivalence point. A conductometric titration of technetate(VII) solutions has also been proposed. (auth)

15964 CONDITIONS OF THE AMPEROMETRIC TITRATION OF MOLYBDENUM WITH POTASSIUM BENZYLDITHIOCARBAMATE USING TWO POLARIZED ELECTRODES. Galushko, S. V.; Usatenko, Yu. I. (Dnepropetrovsk Chemical Engineering Inst., USSR). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 7, 941-942(Jul 1974).

Translated from Zavod. Lab.; 776-778(Jul 1974).

Potassium benzyldithiocarbamate, a reagent easily synthesized and sufficiently stable in acidic media, was used for the titration of molybdenum (VI). A technique for determining molybdenum in steels was developed and tested. The method is more selective than titration with heavy metal salts; unlike titration with thioxine it does not demand prior separation of iron; and it is rather simple and accurate. (LK)

15965 SIMPLE ISOTOPE DILUTION TECHNIQUE FOR THE DETERMINATION OF LEAD AND COPPER IN NATURAL WATERS. Catanzaro, E. J. (Columbia Univ., Palisades, NY). J. Water Pollut. Contr. Fed.; 47: No. 1, 203-204(Jan 1975).

A sample of water is acidified with 2 ml of ultrapure, concentrated HNO_3, and ^{206}Pb and ^{65}Cu spikes (4 and 20 μg, respectively) added. An electrolytic cell is formed so that PbO_2 plates out on the anode and Cu on the cathode. Then mass spectrometric analysis was carried out. ^{235}U has also been added to the sample and results for Cu, Pb, and U in several water samples are given. (MCG)

15966 MEASUREMENTS OF K, Rb, U, Sr, and Pb IN DIAMONDS CONTAINING INCLUSIONS. Welke, H. J. (Univ. of the Witwatersrand, Johannesburg); Allsopp, H. L.; Harris, J. W. Nature (London); 252: No. 5478, 35-37(1 Nov 1974).

Pb and Sr isotopic compositions of inclusions in diamonds may provide constraints on the mode of the geochemical evolution of the Earth, and may make it possible to test assumed U/Pb ratios for the mantle and to estimate the age of diamonds. Preliminary measurements are here reported of K, Rb, Sr, U, and Pb concentrations in diamonds. Two batches of diamonds from the Premier Mine, S. Africa, were investigated, one containing mainly diopside inclusions and the other mainly sulphide inclusions. Details are given of the sample preparation and the mass spectrometric analytical procedure, using the isotope dilution technique, and results are shown tabulated. Sources of error are discussed. The most significant result is that ~30 and 60 ng of Pb and Sr, respectively, were contained in the small quantities of samples used, amounting to ~100 ppm of Pb in the sulphides and ~200 ppm of Sr in the diopsides. The K/Rb ratio of the diopside inclusions was ~200. It appeared that the U/Pb ratio for the source regions of the diamonds is close to 9.0 and that their age is close to 1,500 M yr. A genetic relationship between the diamonds and the original kimberlite magnea is suggested from these and other results. (UK)

15967 ABSTRACTS OF THE 1974 PITTSBURGH CONFERENCE ON ANALYTICAL CHEMISTRY AND APPLIED SPECTROSCOPY, CLEVELAND, OHIO, MARCH 4–8, 1974. Pittsburgh; Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Inc. (1974). 442p. (CONF-740314-(Absts.)).

Some of the analytical methods discussed in the abstracts include: gas chromatography, x-ray fluorescence spectroscopy, mass spectroscopy, voltammetry, atomic absorption spectroscopy, titration, flame photometry, liquid chromatography, infrared spectroscopy, gel permeation chromatography, ion selective electrode analysis, x-ray photoelectron spectroscopy, ion scattering spectrometry, and coulometric titration. (LK)

Radiometric and Radiochemical Procedures

Refer also to abstracts 16522, 16603, and 16968.

15968 (BARC-768, pp 1-10) ELEMENT ANALYSIS WITH SEMICONDUCTOR DETECTOR X-RAY SPECTROMETER. Kapoor, S. S. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

The principal advantage of the semiconductor spectrometer over the wavelength dispersive method in x-ray fluorescence analysis is that it allows simultaneous analysis of all the characteristic x-ray lines together with the background in a single run. Because of the better detection efficiency of this spectrometer a radioisotope source of strength about 10^7 photons/sec can be used for fluorescent excitation of characteristic x-rays of various elements. The semiconductor detector is described and applications of the semiconductor detector x-ray fluorescence system are given. (LK)

15969 (CEA-CONF-2696) STUDY OF A FEW PROBLEMS ARISING IN THE CALIBRATION OF GAMMA PROBES FOR QUALITATIVE AND QUANTITATIVE ANALYSIS OF RADIONUCLIDES IN RADIOPROTECTION. Zerbib, J. C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Protection contre les Rayonnements). 1973. 29p. (In French). (CONF-730557-6). Dep. NTIS (US Sales Only) $4.50.

From meeting for studies of gamma spectrometry; Grenoble, France (7 May 1973).

The problems involved in the use of gamma spectrometry for health physics demand the use of general analytical methods. Because of the diversity of the samples treated, the qualitative analysis is linked to a pulse spectrum fraction consisting of the total absorption peak. A parametric study of the yield curves shows that a range of typical curves can be deduced from a reference curve. The technique saves measurement facilities and numerous experiments. An accurately known yield curve is necessary however, and difficulties remain in the range between about 20 and 100 keV. The use of programmes for automatic pulse spectrum analysis eliminates certain tedious operations but poses problems of different types. (FR)

15970 (HEDL-TME-74-57) USE OF AMERICIUM DIOXIDE AS A PRIMARY STANDARD FOR THE DETERMINATION OF ^{241}Am. Leaf, A. C. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-2170. 32p. Dep. NTIS $4.00.

The use of americium dioxide as a primary standard in both gamma and alpha counting procedures for the determination of Am-241 is described. The results obtained using the two methods are compared, and the precautions required during the preparation and counting of the standard are discussed. (auth)

15971 (RT/PROT-(74)23) DETERMINATION OF PLUTONIUM-239 IN ANIMAL TISSUES AND EXCRETA. The Application of Liquid Scintillation Counting and Extraction Chromatography. Delle Site, A.; Santori, G.; Bazzarri, S. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Sep 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

Methods adopted for the determination of plutonium-239 in tissues, urine, and feces of mice are illustrated. A preliminary study, regarding the quenching effects involved in the α-counting of plutonium by liquid scintillation, indicates HCl as the most suitable aqueous medium. The procedure adopted for the preparation of samples for liquid scintillation counting is described. The organic matter is removed by dry ashing and wet treatment with concentrated HNO_3, and the α-counting of plutonium is performed with Insta-Gel as scintillation liquid. Nearly 100% plutonium recoveries are achieved and the minimum detectable level is 1-2 pCi for a 100-minute count. The analysis of plutonium in urine and feces of mice are carried out by separation of the element on a microthene-tri-n-octylphosphine oxide (TOPO) column and α-counting by a ZnS(Ag) detector. The minimum detectable levels are 0.1 and 0.4 pCi for urine and feces respectively for a 100-minute count. (auth)

15972 (UCID-16658) CONCENTRATION OF TRACE INORGANIC IONS FROM AQUEOUS SOLUTIONS FOR ANALYSIS BY X-RAY FLUORESCENCE SPECTROMETRY. Status Report. Fuchs, C. H.; Ryon, R. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Dec 1974. Contract W-7405-eng-48. 25p. Dep. NTIS $4.25.

The following five possible methods of concentrating inorganic impurities from water are considered: evaporation; precipitation; electrodeposition; ion exchange beads; ion exchange impregnated filter papers; and membrane filtration. Natural waters were analyzed for Ca, Fe, Ni, Cu, Zn, and Sr. (LK)

15973 (UCID-16659) PREPARATION OF URANIUM STANDARD SOLUTIONS FOR X-RAY FLUORESCENCE ANALYSIS. A Safeguards Progress Report. Wong, C. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Dec 1974. Contract W-7405-eng-48. 7p. Dep. NTIS $4.00.

A method has been developed for preparing uranium standard solutions by weighing to an accuracy of 0.1%. This method corrects for variation in aliquoting and for evaporation loss during weighing. The standards are freeze-dried in a configuration suitable for x-ray fluorescence analysis. Three high-precision pipets were compared and found to be unsatisfactory for 0.1% accuracy or precision. (auth)

15974 ASSAY OF RADIOPHARMACEUTICALS. Orvis, A. L. (Mayo Clinic, Rochester, MN). pp 459-483 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

Topics include preparation of calibration sources; systems for absolute counting (4π β–particle detectors and coincidence techniques); secondary counting techniques (standard solutions and reference sources, extrapolation of efficiency curves, and commercial source calibrators); and verification of radionuclide purity. (WHK)

15975 ACCURACY OF MEASUREMENTS OF POTASSIUM CONTENT OF MONKEYS BY IN VIVO BODY COUNTING AS COMPARED TO CHEMICAL ANALYSIS. Kodama, A. M.; Pace, N.; Parot, S. J. (Univ. of California, Berkeley). Phys. Med. Biol.; 19: No. 6, 862-873(Nov 1974).

Gamma spectrometry for the in vivo estimation of total body potassium was evaluated in a sub-human primate, the pig-tailed monkey (Macaca nemestrina). The performance characteristics of a small 4π whole-body scintillation counter and the use of manikin standards in the counting procedure are described. In six animals, the whole body counter overestimated body potassium content by approximately 6% when compared to measurements obtained by total body chemical analysis. By using the data as a calibration curve, body potassium content in pig-tailed monkeys could be predicted with an accuracy of ±3% from the naturally occurring radioisotope, ^{40}K. (auth)

15976 OPTIMIZATION OF THE PROCESS OF MEASURING ^{14}C ACTIVITY AND PROCESSING OF THE RESULTS. Veksler, V. Izv. Akad. Nauk Est. SSR, Khim. Geol.; 23: No. 4, 360-362 (1974). (In Russian).

A method is proposed which makes it possible by optimum selection of the counting time of the standard, background, and sample to reduce the total time for the measurement of the activity of natural radiocarbon and to obtain the necessary accuracy. (tr-auth)

15977 RENTGENORADIOMETRICHESKII METOD OPROBOVANIYA MESTOROZHDENII TSVETNYKH I REDKIKH METALLOV. (X-Ray Radiometric Analysis of Non-Ferrous and Rare Metal Deposits). Leman, E. P. Leningrad; Nedra (1973). 168p. (In Russian).

This book is devoted to the x-radiometric method of assaying ores in natural deposits for use in prospecting for non-ferrous and rare metals (making of subterranean boreholes, sampling of eroded and depleted areas without taking geological samples). The physical bases of the method are considered, the geological and experimental bases of the method of x-ray assay of ores under natural deposit conditions are discussed, apparatus and measurement techniques are described, and the results of the method and production at deposits of tin, arsenic, tungsten, molybdenum, mercury, copper, and polymetals are presented. (tr-auth)

15978 SIMPLE METHOD FOR LIQUID SCINTILLATION COUNTING OF WEAK β-EMITTING LABELLED LIPIDS AFTER SEPARATION BY THIN-LAYER CHROMATOGRAPHY. Pyrovolakis, J. A.; Harry, D. S.; Martin, M. J.; McIntyre, N. (Royal Free Hospital, London). Clin. Chim. Acta; 50: No. 3, 441-444 (Feb 1974).

15979 SEMICONDUCTOGRAPHIC DETERMINATION OF LABELLED SUBSTANCES IN THIN-LAYER CHROMATOGRAPHY. Thkva, R.; Votruba, I. (Ceskoslovenska Akademie Ved, Prague). J. Chromatogr.; 93: No. 2, 399-404(Jun 1974).

A method is presented for the radioactive detection of beta-nuclide-labelled substances in thin-layer chromatography. The method is based on a scanning device with a semiconductor detector; the detection proceeds in the laboratory atmosphere and at room temperature. The measurement and recording may be programmed on a computer. Conditions are considered for ^{3}H- and ^{14}C and ^{35}S, after the chromatographic separation of nuclide acid components. (NL)

15980 CONTROL ANALYSIS OF BORON BY MEASUREMENT OF THE TRANSMISSION OF RADIOISOTOPE SOURCE NEUTRONS. Pierce, T. B.; Boswell, C. R.; Peck, P. F. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Analyst; 99: No. 1184, 774-781(Nov 1974).

Boron at levels of between 0.1 and 10% was determined nondestructively in bulk solids such as boron–aluminium alloys by measurement of the intensity of a transmitted neutron beam. The neutrons were produced from a 300-mCi ^{241}Am–Be source and employed in an automatic instrumental system developed for use in a control laboratory at a rate of up to thirty-six samples per hour. The accuracy of such a technique has been shown to be good and the precision is better than ±1 per cent. The method is best applied to the determination of boron in matrices that have low thermal neutron absorption or scattering cross sections. (auth)

15981 CHARACTERISTICS OF THE MEASUREMENT OF TRITIUM IN PAPER CHROMATOGRAMS. Vdovenko, V. M.; Bobrova, V. N.; Rys'ev, O. A.; Ivanova, I. F. (Radium Inst., Leningrad). Collect. Czech. Chem. Commun.; 39: No. 12, 3640-3648(Dec 1974). (In Russian).

The nature of the differences in the counting efficiency of tritium-labelled preparations in paper chromatography during the introduction of finely dispersed scintillators in the chromatographic medium was studied. Significant differences were found for the counting efficiency in paper chromatography of structurally similar amino acids as DL-alanine-2-^{3}H, DL-leucine-2-^{3}H, and DL-glycine-2-^{3}H. The study of chromatograms of ^{3}H-labelled guanosine on thin layers of cellulose showed the determinative effect of the geometric distribution of the material across the chromatographic layer. Chromatograms were divided into parts with a thickness of 0.5 cm. and the cellulose with stilbene inclusions was carefully mixed and measured in individual cuvettes. It was shown that the signal from spots before chromatographing and the signal from the radioactive zone after chromatographing of identical spot were the same as a result of the mixing of the cellulose. (tr-auth)

Separation Procedures

15982 (BNWL-B-92) SCAVENGING OF PROTACTINIUM FROM THORIUM SOLUTION WITH SILICA GEL AND UNFIRED VYCOR GLASS. Partridge, J. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1971. Contract AT(45-1)-1830. 20p. Dep. NTIS $4.00.

Protactinium adsorption from thoria dissolver solution by batch contact with silica gel and pulverized unfired Vycor glass was investigated. Laboratory and shielded cell tests demonstrated that Pa is removed from a thoria solution by either adsorbent, that the Pa can be leached from either adsorbent, and that the adsorbents can be recycled with no apparent decrease in sorption efficiency. Laboratory studies were performed with synthetic dissolved thoria solution (0.71M Th) containing tracer Pa-233. Low density silica gel was found to be superior to normal density silica gel in adsorption of Pa from the thoria solution. With a given weight of both silica gel and unfired Vycor, Pa adsorption increased as particle size decreased. At a given adsorbent mesh-size, Pa adsorption was greater with low density silica gel than with an equal weight of unfired Vycor. Adsorption of Pa on silica gel was found to be temperature independent. A sodium tartrate solution was found to be effective in leaching Pa from silica gel and unfired Vycor. Elevated temperature increased the leaching rate. Shielded cell tests were made on two solutions (0.71M Th and 1.34M Th) which were prepared by dissolving some recently irradiated thoria waters. Adsorption contacts were 1 hour at ambient temperature. Leaching contacts were 30 minutes at 80°C. Tests in which each absorbent (3-8 mesh low density silica gel and 8-20 mesh unfired Vycor) was put through six sorption-leach cycles demonstrated that either adsorbent should be usable for many sorption-leach cycles without degradation of its sorption efficiency. (auth)

15983 CONCENTRATION OF YTTRIUM, LANTHANUM, AND CERIUM USING A THREE-PHASE THIOCYANATE EXTRACTION SYSTEM. Kalmykova, I. S.; Mezentseva, V. F.; Makhnev, Yu. A.; Zhivopistsev, V. P. (Perm Polytechnic Inst., USSR). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 7, 933-934 (Jul 1974).

Translated from Zavod. Lab.; 769-771(Jul 1974).

The possibility of concentrating yttrium, lanthanum, and cerium using diantipyrimethane (DAM) in a third phase was investigated. The effects of the acidity of the medium, the concentration of thiocyanate ions, the concentration of DAM, and the ratio of the volumes of the aqueous and organic phases were studied. (LK)

15984 URANYL SULFATE NON-CATION EXCHANGE EXTRACTION BY MIXTURES OF DI-2-ETHYLHEXYLPHOSPHORIC ACID AND URANYL DI-2-ETHYLHEXYLPHOSPHATE WITH TBP. Mikhailov, V. A.; Torgov, V. G.; Us, T. V. (Inst. of Inorganic Chemistry, Novosibirsk, USSR). Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk; No. 6, 67-77(Nov 1974). (In Russian).

Mechanism of uranium extraction by mixtures of D2EHPA with TBP from concentrated uranyl sulfate solutions is studied. The synergetic effect is shown to be due to non-cation extraction of uranyl sulfate by uranyl di-2-ethylhexylphosphate in the presence of TBP. (auth)

15985 SOLVENT EXTRACTION AND EXTRACTION-CHROMATOGRAPHIC SEPARATION OF METALS FROM HYDROCHLORIC ACID SOLUTIONS BY USING SULFOXIDES. Brodskaya, G. A.; Gureev, E. S.; Usachenko, V. S.; Zolotov, Yu. A. (Inst. of Nuclear Physics, Tashkent). Zh. Anal. Khim.; 29: No. 11, 2209-2215(Nov 1974). (In Russian).

Solvent extraction was studied of In, Sn(IV), Ga and Cd from hydrochloric acid solutions with toluene solutions of dihexylsulfoxide as well as of Cu, Ag, Au(III), Zn, Cd, Sc, Ga, In, Eu, Yb, Sn(IV), Ge, Sb(III), Mo(VI), W(VI), Mn(II), Te(VII), Re(VII), Fe(III), Co, Pt(IV), and Pd with 10% solutions of petroleum sulfoxides in toluene. The effect of HCl, sulfoxides, and metal concentration on the extraction was examined. The maximum extraction of many elements is located at 5 to 6 *M* HCl. The results obtained were used to develop procedures of extraction-chromatographic separation of In and Sn, In and Ga. Using columns packed with teflon and saturated with petroleum sulfoxides or their toluene solutions it is possible to separate macroamounts of indium from tin and gallium, macroamounts of tin from indium, and to obtain ^{113m}In from tin irradiated with neutrons. (auth)

15986 APPLICATION OF COLUMN REDOX-EXTRACTION CHROMATOGRAPHY TO THE SEPARATION OF SOME ACTINIDE ELEMENTS. delle Site, A.; Testa, C. (CNEN, Rome). Anal. Chim. Acta; 72: No. 1, 155-161(Sep 1974).

The application of a new technique to the separation of some actinide elements by means of a single reducing and extracting column is described. Tri-n-octyl-phosphine oxide (TOPO) was used as the extractant. The following reducing agents were supported on microporous polyethylene together with TOPO: tetrachloro-hydroquinone, 2,3-dichloro-1,4-naphthahydroquinone, 2,5-di-tert-butylhydroquinone and 2,5-di-tert-pentylhydroquinone. The last compound was chosen for the separation experiments; it allowed quantitative reduction of plutonium to Pu(III) and of neptunium to Np(IV). The separations Pu(III)–Np(IV), Pu(III)–

U(VI) and Am(III)–Np(IV) in 6 M hydrochloric acid were obtained. (NL)

15987 CO-EXTRACTION OF WATER IN URANYL β-DIKETONE-OXODONOR SYNGERGISTIC SYSTEMS. Subramanian, M. S.; Khopkar, P. K.; Shukla, J. P.; Pai, S. A. (Bhabha Atomic Research Center, Bombay). J. Inorg. Nucl. Chem.; 36: No. 12, 3862-3863(Dec 1974).

Experiments were undertaken to determine the water uptake by uranyl synergistic complexes $UO_2(TTA)_2S$ (where TTA = thenoyltrifluoroacetone, S = diphenyl sulfoxide (DPSO), tributyl phosphate (TBP), di-n-hexyl sulfoxide (DHSO) or trioctyl phosphine oxide (TOPO), when the complex was extracted from an aqueous solution into benzene. The results indicate that whereas $UO_2(TTA)_2$ TOPO is extracted in an anhydrous form, the complexes with DPSO, TBP and DHSO are accompanied by varying amounts of water in the organic phase. The amount of water extracted appears to be inversely proportional to the basicity of the donors. (UK)

15988 DISTRIBUTION OF TRACE PLUTONIUM(VI) BETWEEN PURE TRI-n-BUTYL PHOSPHATE AND AQUEOUS NITRIC ACID. Magon, L.; McKay, H. A. C.; Wain, A. G. (United Kingdom Atomic Energy Authority, Harwell, Eng.). J. Inorg. Nucl. Chem.; 36: No. 12, 3849-3851(Dec 1974).

A survey of the extraction of the transuranium elements by neutral organophosphorus compounds revealed serious discrepancies in the values given in the literature for the distribution of traces of Pu(VI) between pure tri-n-butyl phosphate (TBP) and aqueous nitric acid. This note seeks to establish reliable values for the distribution coefficients, $D_{Pu(VI)}$. Possible sources of error in $D_{Pu(VI)}$ measurements at trace plutonium levels are considered, and steps taken to avoid errors in the presently-reported experiments are outlined. Results are presented and discussed. (UK)

15989 SOLVENT EXTRACTION OF CIS- AND TRANSURANIUM ELEMENTS FROM FUSED ALKALI NITRATES. Foos, J.; Guillamont, R. (Paris Univ., Orsay, France). J. Inorg. Nucl. Chem.; 36: No. 12, 3833-3837(Dec 1974). (In French).

Solvent extraction of Ac, Th and 5f elements up to Cf at 150°C from a molten $LiNO_3$-KNO_3/$\frac{1}{2}$ eutectic by TBP or TPPO in a polyphenyl mixture has been studied. Plots of the log distribution coefficients of these elements vs log free TBP or TPPO concentration in the organic phase are reported, except for Pa which is not extracted. The behavior of Th, in extraction from such a system is different from that of other elements. (auth)

15990 EXTRACTION OF URANYL NITRATE AND THORIUM NITRATE BY METHYL DIPHENYL PHOSPHATE. Apelblat, A. (Israel Atomic Energy Commission, Beersheba). J. Chem. Soc., Faraday Trans., I; 70: 2033-2037(1974).

Partition studies have been carried out for the uranyl nitrate–water–methyl diphenyl phosphate and thorium nitrate–water–methyl diphenyl phosphate systems. The activities of methyl diphenyl phosphate were calculated for the uranyl nitrate ternary system. Uranyl nitrate is better extracted by methyl diphenyl phosphate than is thorium nitrate. The same picture is observed in relation to water for both systems. (auth)

15991 ANION-EXCHANGE BEHAVIOR OF INDIUM(III) IN CITRATE AND TARTRATE SOLUTIONS: SEPARATION FROM MIXTURES. Sitaram, R.; Khopkar, S. M. (Indian Inst. of Tech., Bombay). Anal. Chim. Acta; 71: No. 2, 472-476(1974).

15992 FLOATATION OF Zr TITANIUM PRODUCTS IN SEA WATER. Yampol'skaya, M. Ya.; Vtorina, L. S. Tsvetn. Metal.; No. 9, 84-86(Sep 1974). (In Russian).

Flotation and foam methods of separating Zr titanite from seawater (similar to a fresh-water scheme) were used to obtain conditioned, zirconium, and quartz-feldspar concentrates. (tr-auth)

15993 METHOD FOR REMOVING ALKYL IODIDES FROM AIR BY MERCURIC NITRATE SOLUTION. Schmitt, J. M.; Crouse, D. J. Jr.; Howerton, W. B. (to United States Atomic Energy Commission). US Patent 3,852,407. 3 Dec 1974. Filed date 8 Aug 1972. 8p.

An improved process for contacting and removing iodine and particularly alkyl iodides from an air stream comprising the use of a relatively concentrated nitric acid solution comprising mercuric ions recycled through a gas contactor is described. Concurrently, a minor fraction of the solution is passed through an evaporator to oxidize and concentrate the accumulated iodine causing it to precipitate as mercuric iodate, thereby allowing essentially complete recycle of the mercury and nitric acid. (Official Gazette)

15994 RARE EARTH ION EXCHANGE OF SYNTHETIC FAUJASITE SUBSTITUTED ISOMORPHOUSLY BY BORON. Onu, P.; Ababi, V. (Univ., Iasi). Rev. Roum. Chim.; 19: No. 7, 1279-1282 (Jul 1974).

The ion exchange capacity for europium and uranyl of synthetic faujasite zeolites, substituted isomorphously by boron, was studied. The ion exchange process is comparatively analyzed relative to that involving X or Y type zeolites but without boron in their composition. Also, a few data about the thermal stability of the samples investigated are presented. (auth)

15995 STRONTIUM EXTRACTION BY DIFFERENT MONOCARBOXYLIC ACIDS. Mikhailichenko, A. I.; Klimenko, M. A.; Fedulova, T. V. Zh. Neorg. Khim.; 19: No. 12, 3344-3348(Dec 1974). (In Russian).

A study of strontium extraction by monocarboxylic acids showed that the length of a normal aliphatic chain has practically no effect on the extraction capability of an acid, but branching in the presence of a double bond in the radical decreased the extraction capability. The effect of these factors decreased with distance from the reaction center, i.e., the carboxyl group. An increase in the number of alkyl radicals on the alpha-carbon atom caused a sharp decrease in the extraction capability. Strontium was extracted by monocarboxylic acids with radicals of normal structure according to the equation $Sr^{2+}_{aq} + 4H_2O_{aq} + 3(HA)_{2\ org} \rightleftharpoons (SrA_2 \cdot 4HA \cdot 4H_2O)_{org} + 2H^+_{aq}$. (tr-auth)

15996 LIQUID–LIQUID EXTRACTION BY ALKYL PHOSPHORIC ESTERS. III. Separation of the Yttrium–Gadolinium Pair by di-(2-Ethylhexyl)Phosphoric Acid. Brunisholz, G.; Hirsbrunner, W. (Univ., Lausanne, Switzerland). Helv. Chim. Acta; 57: No. 8, 2483-2487(18 Dec 1974). (In French).

The separation of yttrium and gadolinium by solvent extraction with di-(2-ethylhexyl)phosphoric acid (HDEHP) from solutions in HNO_3 has been studied. The extraction takes place by the same mechanism for both elements. The extraction by the ion-exchange reaction is more selective than the extraction by the solvation reaction. Methyl isobutyl ketone, compared to kerosene as diluent for (HDEHP), reduces more the extraction of Y than that of Gd, without affecting the mechanisms. (auth)

15997 CONCENTRATION OF SOME MICROELEMENTS BY COPRECIPITATION WITH IRON HYDROXIDE DURING THEIR SPECTRAL DETERMINATION. Lebedinskaya, M. P.; Chuiko, V. T. (Dnepropetrovsk State Univ., Makhachkala, USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 12, 1862-1864(1974). (In Russian).

The coprecipitation of Ba, As(V), Mo(VI), Nb(V), and V from natural water with iron hydroxide during variation of the pH of the solution was studied. At pH 8 to 9 V is coprecipitated quantitatively. The degree of coprecipitation of Nb and Mo increases with increase of the pH from 3 to 8, not reaching a quantitative value, and then decreases. The degree of coprecipitation of W depends slightly on the pH of the solution. At pH from 8 to 9 As is coprecipitated ~85 to 90%. Ba under these conditions is almost completely unprecipitated. (tr-auth)

15998 DYNAMICS OF ION-EXCHANGE SORPTION IN THE PRESENCE OF COMPLEX-FORMING AGENTS. III. Selective Elution for a Concave Sorption Isotherm. Matorina, N. N.; Buchatskii, P. M.; Chmutov, K. V. (Inst. of Physical Chemistry, Moscow). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 4, 562-564(Apr 1974).

Translated from Zh. Fiz. Khim.; 48: No. 4, 976-979(Apr 1974).

The dynamics of sorption was investigated in the presence of complex-forming agents for a concave sorption isotherm in the separation of yttrium and cerium with diethylenetriaminepentaacetic acid solution using the elution method. The possibility of calculating the conditions for concave sorption isotherms has been demonstrated. The rate of migration and the width of the sharpened yttrium front have been calculated. The calculated quantities agree satisfactorily with the experimental results. (auth)

15999 RELATIVE EFFICIENCIES OF DISPLACEMENT AND ELUTION CHROMATOGRAPHY IN THE SEPARATION OF MACROAMOUNTS OF LANTHANIDES BY A DIETHYLENETRIAMINEPENTAACETIC ACID SOLUTION. Sheptunov, V. N.; Kalinichev, A. I.; Nazarov, P. P.; Chmutov, K. V. (Inst. of Physical Chemistry, Moscow). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 4, 556-558(Apr 1974).

Translated from Zh. Fiz. Khim.; 48: No. 4, 967-969(Apr 1974).

The efficiencies of the separation of macroamounts of lanthanides by elution and displacement complex-formation chromatography have been compared with the aid of Glueckauf's equations. The calculations were based on experimental heights equivalent to theoretical plates (HETP) and the separation factors. (auth)

16000 EXTRACTION OF CESIUM FROM ALKALINE-SULFATE MEDIUM BY SOLUTIONS OF OKTOFOR-S IN KEROSENE. Granat, D. A.; Reznik, A. M.; Plyushchev, V. E. (Moscow Inst. of Fine Chemical Tech.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 12, 1787-1790(1974). (In Russian).

Oktofor-S is the product of the condensation of paraoctylphenol disulfide with formaldehyde. The distribution of Cs between alkaline-sulfate solutions and 0.12M oktofor-S in kerosene was studied. On the basis of these data isotherms for pH 10, 11, 12, and 13 were constructed by graphic methods. The dependence D_{Cs} = f(pH) has an extreme character and passes through a maximu and then with increase of the Cs concentration D_{Cs} decreases. (tr-auth)

Inorganic, Organic, and Physical Chemistry

Refer also to abstract 17534.

Chemical and Physicochemical Properties

Refer also to abstracts 17050, 17058, 17133, 17172, 17340, 17378, 17558, and 19030.

16001 (RN-S-0032) COMPUTATION OF THERMODYNAMIC PROPERTIES OF PARA HYDROGEN SUBROUTINE PROPH. (Aerojet-General Corp., Azusa, Calif. (USA)). Apr 1964. 33p. Dep. NTIS $4.75.

Subroutine PROPH is a digital program which calculates the temperature (°R) and specific volume (in.^{3}/lb) of para-hydrogen. The equations are applicable for a defined pressure-enthalpy region. An appropriate boundary value is used if a calculation is attempted at a point outside this region. This program was written in connection with the Engine System Simulator program, which requires a high speed computation of the temperature and specific volume for given values of pressure and enthalpy. In PROPH, the temperature and specific volume are calculated directly, without iteration, and it is, therefore, computationally fast. The accuracy of the derived equations is based on comparisons with property values from other references. The overall mean and standard deviation of the residuals are 0.1% and 0.8%, respectively. Of over 15,000 data points compared, only two showed deviations greater than 5.5%. (auth)

16002 SYNTHESIS AND PHYSICO-CHEMICAL PROPERTIES OF HOLMIUM AND ERBIUM PERTECHNETATES. Zaitseva, L. L.; Konarev, M. I.; Belikov, A. D.; Sukhikh, A. I.; Chebotarev, N. T. Zh. Neorg. Khim.; 19: No. 12, 3248-3252(Dec 1974). (In Russian).

The pertechnetates $Ho(TcO_4)_3 \cdot 4H_2O$ and $Er(TcO_4)_3 \cdot 4H_2O$ were synthesized. The thermal stability of the initial crystallohydrates and the limits of existence of the tetrahydrates, dihydrates, and anhydrous forms were studied. X-ray studies showed the isostructural nature of the initial and intermediate crystallohydrates and the anhydrous pertechnetates of holmium and erbium both among themselves and similar salts of rhenic acid. (tr-auth)

16003 AMORPHOUS SOLID WATER: A NEUTRON DIFFRACTION STUDY. Wenzel, J. (Research Establishment Risoe, Roskilde, Denmark); Linderstroem-Lang, Rice, S. A. Science; 187: No. 4175, 428-430(7 Feb 1975).

The structure factor of amorphous solid D_2O deposited from the vapor at 10°K was obtained by measuring the neutron diffraction spectrum in the wave vector transfer from 0.8 to 12.3 reciprocal angstroms. The results indicate that the phase investigated is amorphous and has a liquid-like structure factor. The Fourier-transformed structure factor yields a real space pair distribution function consistent with local tetrahedral coordination and hydrogen bonding, as in other condensed phases of water. The intramolecular OD separation is 1.00 angstrom; the lack of data for very large wave vector transfer and the expected near equality of the intramolecular DD separation and intermolecular O . . . D separation make it impossible to determine the intramolecular DOD angle with precision. The neutron scattering data presented are complementary to the x-ray diffraction studies of Venkatesh, Rice, and Narten. (auth)

16004 CONTINUOUS RANDOM NETWORK MODEL FOR AMORPHOUS SOLID WATER. Alben, R.; Boutron, P. (CNRS, Grenoble, France). Science; 187: No. 4175, 430-432(7 Feb 1975).

Continuous random network models representing amorphous solid water have been constructed. The x-ray and neutron scattering predictions for one type of model agree quite well with experimental results. (auth)

16005 THERMODYNAMICS OF THE DISSOLUTION OF SOME HALOGENIDES OF THE ALKALI AND ALKALINE-EARTH METALS IN H_2O AND D_2O AT DIFFERENT TEMPERATURES. Krestov, G. A.; Abrosimov, V. K.; Makarov, G. N. (Ivanov Energy Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 12, 1867-1870(1974). (In Russian).

The integral thermal effects of the dissolution of KF, KI, RbCl, and CsBr in H_2O and of LiCl, NaCl, KBr, KI, RbCl, CsBr, $SrCl_2$, and $Ca(NO_3)_2$ in D_2O were measured on an isoperibolic microcalorimeter in the temperature interval from 10 to 85°C and electrolyte concentrations from 0.005 to 0.1M. On the basis of the experimental data obtained and literature data, the standard changes of the isobar-isothermal potential, enthalpy, specific heat, and entropy were calculated for the dissolution of the salts in H_2O and D_2O in the interval from 0 to 100°C. The changes of these thermodynamic characteristics of the dissolution with temperature were discussed from the viewpoint of the effects of the solvent isotopes and temperature on the structure of the water. (tr-auth)

16006 ABSOLUTE VISCOSITY OF $D_2{}^{18}O$ BETWEEN 15 AND 35°. Kudish, A. I.; Wolf, D. (Weizmann Inst. of Science, Rehovot, Israel). J. Phys. Chem.; 79: No. 3, 272-275(30 Jan 1975).

Absolute viscosity values for highly enriched $D_2{}^{18}O$ samples were measured at 5° intervals between 15 and 35°C using a semi-automatic closed viscometer of the suspended-level type. The absolute viscosity of 100% $D_2{}^{18}O$ was determined by extrapolation of the experimental data by means of Eyring's absolute rate theory of viscosity. In order to perform the above extrapolations certain assumptions had to be made concerning the nonnegligible amount of HDO present in the samples. (auth)

Isotope Effects

Refer also to abstracts 16085, 17372, 18106, 18129, and 18173.

16007 ROLE OF QUANTUM STATISTICS IN ISOTOPE EFFECTS IN LOW-TEMPERATURE ADSORPTION. Parbuzin, V. S.; Malyavskii, V. I. Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 5, 547-549(1974). (In Russian).

The effects of quantum-statistical properties of particles on isotope equilibria in low-temperature adsorption were investigated. The abnormal dependence of the selectivity factor on the surface coverage for helium isotopes adsorbed on zeolite NaX is explained by the difference in the quantum-statistical behavior of these isotopes. (auth)

16008 ISOTOPE EFFECT IN HYDROGEN EXCHANGE REACTION BETWEEN PYRROLE AND HYDROGEN CHLORIDE. Szydlowski, J.; Jelinska, M. (Univ., Warsaw). Rocz. Chem.; 48: No. 11, 2037-2043(1974).

Isotope fractionation of tritium between pyrrole in the solid phase and in CCl_4 solution and gaseous hydrogen chloride at various temperatures was studied. The measured isotope effects are discussed within the framework of quantum-statistical theory of isotope effects. (auth)

16009 SECONDARY DEUTERIUM KINETIC ISOTOPE EFFECTS ASSOCIATED WITH MULTIPLE DEUTERIATION OF TRIMETHYLAMMONIUM LEAVING GROUPS IN SOME E1 AND E2 REACTIONS. Cooper, G. H.; Bartlett, J. S.; Farid, A. M.; Orchard, D. G. (Univ. of Sheffield, Eng.). J. Chem. Soc., Chem. Commun.; No. 22, 950-951(20 Nov 1974).

Large normal ($k_H/k_D > 1$) secondary deuterium kinetic isotope effects have been observed in E1 and E2 reactions of some steroidal axial trimethylammonium salts when the leaving groups were partly or fully deuterated; analogous but much smaller effects have been observed in E2 reactions of 2-phenylethyltrimethylammonium salts. (auth)

16010 TRIPLET EXCITON PERCOLATION AND SUPEREXCHANGE: NAPHTHALENE $C_{10}H_8$–$C_{10}D_8$. Kopelman, R.; Monberg, E.M.; Ochs, F.W.; Prasad, P.N. (Department of Chemistry, The University of Michigan, Ann Arbor, Michigan 48104). J. Chem. Phys. 62: No. 1, 292-293 (1 Jan 1975).

The phosphorescence of betamethylnaphthalene doped into a naphthalene–h_8/naphthalene–d_8 mixed crystal has been measured. The results demonstrate that (1) dynamical exciton percolation does occur (i.e., a transition from an exciton insulator to an exciton conductor), that (2) it is very useful for the investigation of energy transfer in molecular aggregates, and that (3) it is a critical test of our current knowledge of exciton exchange and superexchange. (AIP)

16011 HOT BAND AND ISOTOPIC STRUCTURE IN THE RESONANCE RAMAN SPECTRUM OF BROMINE VAPOR. Baierl, P.; Kiefer, W. (Sektion Physik der Universität München, Lehrstuhl Prof. Brandmüller, D−8000 München 40, Schellingstrasse 4, Federal Republic of Germany). J. Chem. Phys. 62: No. 1, 306-308 (1 Jan 1975).

The fine structure of the fundamental region of the bromine resonance Raman spectrum is presented. It is analyzed in terms of isotopic splitting of the species $^{79}Br_2$, $^{79}Br\ ^{81}Br$, and $^{81}Br_2$. (AIP) (auth)

16012 MICROWAVE SPECTRUM OF PROPIONIC ACID. I. SPECTRUM, DIPOLE MOMENT, BARRIER TO INTERNAL ROTATION, AND LOW−FREQUENCY VIBRATIONS OF *cis*−PROPIONIC ACID. Stiefvater, O.L. (Department of Chemistry, Harvard University, Cambridge, Massachusetts 02138). J. Chem. Phys. 62: No. 1, 233-243 (1 Jan 1975).

From its rotation spectrum propionic acid (CH_3CH_2COOH) is shown to exist predominantly in a *cis*−conformation in which the methyl group eclipses the carbonyl bond and with the hydroxyl hydrogen between the two oxygen atoms. The dipole moment of this rotamer is $\mu = 1.55 \pm 0.03$ D ($\mu_a = 0.19$ D, $\mu_b = 1.54$ D). From the variation of its components under isotopic substitution the dipole moment deviates by $(5.3 \pm 1.5)^\circ$ from the C = O bond toward the hydroxyl group. The barrier hindering internal rotation of the methyl group has been determined for four isotopic forms with the result $V_3 = 2340 \pm 30$ cal/mole for CH_3CH_2COOH and CH_3CH_2COOD and $V_3 = 2370 \pm 30$ cal/mole for CH_3CD_2COOH and CH_3CD_2COOD. Satellite spectra from 24 different vibrational levels have been analyzed by double resonance techniques. The five lowest vibrational modes of *cis*−propionic acid have been assigned: C−C torsion at 64 ± 3 cm $^{-1}$, CH_3 internal rotation at 190.4 cm^{-1}, CCC deformation at 270 ± 15 cm^{-1}, with tentative vibrational assignments of δ (CCO) at 530 ± 30 cm^{-1}, τ (OH) at 547 ± 20 cm^{-1}. (auth)

16013 *g* TENSOR OF TRIPLET BENZOPHENONE. Sharnoff, M.; Iturbe, E.B. (Department of Physics, University of Delaware, Newark, Delaware 19711). J. Chem. Phys. 62: No. 1, 145-156 (1 Jan 1975).

Optically detected high field EPR measurements are reported on pure orthorhombic single crystals of normal and deuterium−enriched benzophenone. The results are used to obtain the molecular and excitonic spin Hamiltonians, and these are examined in turn to derive information concerning spin−orbit coupling matrix elements between the metastable triplet state and other levels. It is found that the metastable triplet interacts about as strongly with the $n\sigma^*$ configuration as with the $\pi\pi^*$ configuration, suggesting that each of the spin sublevel energies of $^3\pi\pi^*$ is affected about as strongly by spin−orbit coupling as by direct magnetic dipolar interaction. It does not seem possible, however, to reconcile the *g* tensors with semiempirical LCAO MO theory based on SCF calculations for the normal state. The molecular *g* values are $g_x = 1.9990 \pm 0.0006$, $g_y = 1.9994 \pm 0.0006$, and $g_z = 2.0097 \pm 0.0006$. The principal *z* axis coincides with the direction of the carbonyl bond, while the *x* and *y* axes make angles of $60^\circ \pm 2^\circ$ and $30^\circ \pm 2^\circ$ respectively, with the plane of the carbonyl group. The principal values of the molecular fine−structure tensor are $X = -2137.3 \pm 0.3$ MHz, $Y = -896.3 \pm 0.5$ MHz, and $Z = +3033.7 \pm 1.0$ MHz. The principal *z* axis of this tensor also coincides with the carbonyl bond, but its remaining principal axes are rotated by about 10° from the *x* and *y* axes of the *g* tensor. The direction of rotation is such as to diminish the inclination of the *yz* plane to the plane of the carbonyl group. The principal axes of tensors characterizing the triplet excitons coincide with the crystralline *a*, *b*, and *c* axes. The principal *g* values are $g_a = 2.0002 \pm 0.0003$, $g_b = 2.0085 \pm 0.0003$, and $g_c = 2.0013 \pm 0.0003$, while the corresponding fine−structure principal values are $A = -819.4 \pm 0.4$ MHz, $B = +2639.9 \pm 0.2$ MHz, and $C = -1820.1 \pm 0.4$ MHz. It is demonstrated that the excitonic spin Hamiltonian is consistent with the average of the magnetically inequivalent molecular Hamiltonians. (auth)

16014 MICROWAVE SPECTRUM OF PROPIONIC ACID. II. STRUCTURE OF *cis*−PROPIONIC ACID BY DOUBLE RESONANCE MODULATION MICROWAVE SPECTROSCOPY. Stiefvater, O.L. (Department of Chemistry, Harvard University, Cambridge, Massachusetts 02138). J. Chem. Phys. 62: No. 1, 244-256 (1 Jan 1975).

Microwave double resonance modulation has been used for the first time to observe all the isotopic species spectra that are needed for a structure determination by the microwave method. From spectra of the normal and thirteen isotopically labelled species of *cis*−propionic acid the substitution structure of this molecule has been determined completely. Bond lengths (in Å) are as follows; $C_{keto}-C_{methylene} = 1.509 \pm 0.002$, $C_{methylene}-C_{methyl} = 1.523 \pm 0.003$, $C{=}O = 1.210 \pm 0.001$, $C-O = 1.352 \pm 0.002$, $O-H = 0.970 \pm 0.001$, $(C-H)_{methylene} = 1.098 \pm 0.002$, $(C-H)_{methyl} = 1.088 \pm 0.002$. The nonbonded distance between the oxygen atoms is 2.245 ± 0.001 Å. The bond angles are (in degrees): $\angle$ CCC $= 112.7 \pm 0.1$, $\angle$ $(HCH)_{methylene} = 106.4 \pm 0.2$, $\angle$ $(HCH)_{methyl} = 108.6 \pm 0.2$, $\angle$ $(CCH)_{methyl} = 110.0 \pm 0.3$, $\angle$ C=O $= 125.8 \pm 0.2$, $\angle$ CC−O $= 111.8 \pm 0.1$ and $\angle$ COH $= 105.8 \pm 0.2$. The plane HCH of the methylene hydrogens is tilted by $4.9 \pm 0.1^\circ$ from the external bisector of the CCC−angle towards the hydroxyl oxygen atom. Spectra corresponding to the first excited state of the large amplitude, torsional vibration around the central carbon−carbon bond have been analyzed for all 14 isotopic forms, enabling the extrapolation to torsional equilibrium moments. Structure calculations based on these moments show that the torsional vibration has no significant influence on the ground state structure. For the normal and four deuterated species the effects of the three lowest vibrations could be eliminated from the ground state constants. The corresponding structure calculations suggest that the out−of−plane carbon−hydrogen bonds derived from ground state constants contain a contribution of 0.005 and 0.002 Å, respectively, for the methylene and methyl hydrogens due to the combined zero−point effects of these three vibrations. The heavy skeleton structure of propionic acid appears little affected, however. (auth)

16015 ISOTOPE CHEMISTRY AND MOLECULAR STRUCTURE. TOTAL DEUTERIUM ISOTOPE EFFECTS. Bigeleisen, J. (Department of Chemistry, University of Rochester, Rochester, New York 14627); Ishida, T. J. Chem. Phys. 62: No. 1, 80-88 (1 Jan 1975).

A qualitative discussion is given on the relationship between the magnitude of isotope effects in polyatomic systems and bending and stretching force constants. This is followed by a general method for the calculation of the isotope effect which can be ascribed to each force constant in the general quadratic potential energy for the vibration of a polyatomic molecule. The method is applied to deuterium isotope effects in the molecules H_2O, CH_2O, CH_4, C_2H_4, C_2H_6, and C_6H_6 at and above 300°K. It is found that deuterium isotope effects associated with individual internal valence force constants are nearly additive at room temperature. Strict additivity holds in the high temperature limit. Bond stretching force constants account for at least 65% of the total deuterium−to−protium reduced partition function ratio at 300°K and become even more dominant at higher temperatures. The origin of the relative importance of stretching and bending forces as a function of temperature is found in the first two terms of the finite orthogonal polynomial method of Bigeleisen and Ishida. Correlations are established between the magnitude of deuterium isotope effects in different molecules as a function of temperature with stretching and bending force constants. (auth)

16016 DIFFUSION IN LIQUID MIXTURES OF ISOTOPES. Ebbsjoe, I. (Aktiebolaget Atomenergi, Studsvik, Sweden); Waller, I.; Schofield, P.; Skoekd, K. J. Phys., C (London); 7: No. 21, 3891-3908(7 Nov 1974).

Molecular dynamics calculations of the velocity autocorrelation functions and self-diffusion coefficients in two-component liquid mixtures consisting of the argon isotope of mass 40 and, in order to obtain a clear isotope effect, fictitious argon isotopes of one of the masses 32, 80 and 200 were used. A perturbation theory, in principle being an expansion in powers of the mass difference of the two isotopes in the mixtures, was developed and used for the analysis of the results for the velocity autocorrelation functions, permitting also the calculation of isotope effects for mass differences occurring in mixtures of real isotopes. The connection between the mutual and self-diffusion coefficients and the relation of the results to binary collision and hydrodynamic theory is briefly considered. (auth)

16017 THERMODYNAMIC ISOTOPE EFFECTS IN ORGANIC COMPOUNDS. V. Carbon Isotope Effects in Alicyclic and Aromatic Hydrocarbons. Galimov, E. M.; Ivlev, A. A. (Moscow Inst. of the Petrochemical and Gas Industry). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 4, 551-553(Apr 1974).

Translated from Zh. Fiz. Khim.; 48: No. 4, 957-960(Apr 1974).

The intramolecular thermodynamic carbon isotope effects (β-factors) were calculated for cyclohexane, benzene, and toluene. The β_Σ-factor for cyclohexane is higher than for normal alkanes and is close to the values for aromatic compounds which corresponds to their maximum enrichment in the heavy carbon isotope. Despite the slight differences in the distribution of carbon isotopes in the benzene and toluene rings, their β_Σ-factors are almost identical. (auth)

16018 THERMODYNAMIC ISOTOPE EFFECTS IN ORGANIC COMPOUNDS. VII. Nitrogen Isotope Effects. Ivlev, A. A.; Koroleva, M. Ya.; Trans Suan Khoan; Klima, M. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 5, 663-664(May 1974).

Translated from Zh. Fiz. Khim.; 48: No. 5, 1143-1146(May 1974).

The results of the calculation of the thermodynamic nitrogen isotope effects (β-factors) in ammonia, methylamine, pyrrolidine, pyrrolizidine, and azobenzene are presented. The nature of the distribution of the nitrogen isotopes in organic molecules has been examined. A significant influence of nitrogen on the isotope effects of the other atoms involved in the process, which is transmitted via kinetic and dynamic interactions, has been noted. The β-factors for carbon and hydrogen in the nitrogen-containing compounds examined are quoted. (auth)

16019 ISOTOPE EFFECT ON THE HYPERFINE SPLITTINGS OF THE DEUTERIOBENZENE ANIONS: AN EXAMPLE OF THE DYNAMIC JAHN–TELLER EFFECT. Purins, D. (Department of Chemistry, Adelphi University, Garden City, New York 11530); Karplus, M. J. Chem. Phys. 62: No. 2, 320-332 (15 Jan 1975).

The vibronic wavefunctions and energy levels of the benzene, benzene–1–d, benzene–2,6–d_2, benzene–1,4–d_2, and benzene–1,3,5–d_3 anion radicals have been obtained and used to determine the effect of deuterium substitution on the degenerate energy levels and spin densities of the benzene anion. It is shown that a dynamic Jahn–Teller effect treatment is required for these systems to obtain a quantitative interpretation of the consequences of deuterium substitution. The ground vibronic states of benzene$^-$ and benzene–1,3,5–d_3^- are degenerate. In benzene–2,6–d_2^-, the symmetric state (A_1 under C_{2v}) is 22 cm^{-1} below the antisymmetric state (B_1 under C_{2v}). In benzene–1–d^- and benzene–1,4–d_2^-, the antisymmetric states are lower by 9 and 39 cm^{-1}, respectively. The benzene–2,6–d_2^- and benzene–1,4–d_2^- hyperfine coupling constants and their temperature dependence calculated using the vibronic wavefunctions and energy splittings are in very good agreement with the experimental values. For benzene–1–d, the experimental splitting is estimated to be 20 cm^{-1}, about twice as large as the calculated value, and agreement between the experimental and calculated hyperfine constants is less satisfactory. The vibronic energy splitting is interpreted in terms of the effect of deuterium substitution on the vibrational potential energies corresponding to the symmetric and antisymmetric electronic states. Calculations of the expectation values of the unpaired electron energy over the neutral molecule and the two anion Born–Oppenheimer state vibrational functions show that changes in the average values of the out–of–plane bending coordinates upon deuteration lead to a splitting of the vibrational potential energies. To a first approximation, the differences among the anions are a function of the unpaired orbital bond orders at the deuterated positions in the two electronic states. If the substituted bond order is large and negative, deuterium substitution increases the vibrational potential energy, but if it is approximately zero, the potential energy is essentially unchanged. (auth)

16020 VIBRATIONAL ENERGY TRANSFER FROM THE (00°1) LEVEL OF $^{14}N_2O$ AND $^{12}CO_2$ TO THE (m, n^l, 1) LEVELS OF THESE MOLECULES AND OF THEIR ISOTOPIC SPECIES. Doyennette, L.; Margottin–Maclou, M.; Chakroun, A.; Gueguen, H.; Henry, L. (Laboratoire de Spectronomie Moléculaire, Université de Paris VI, 4 Place Jussieu, 75005 Paris, France). J. Chem. Phys. 62: No. 2, 440-447 (15 Jan 1975).

We have studied versus temperature the fast vibrational energy transfers which occur between two nitrous oxide molecules, or two carbon dioxide molecules, initially excited by a laser pulse into the (00°1) level. These transfers occur upon near–resonant collisions of the type $M(m, n^l, 1) + M(m', n'^{l'}, 0) \rightleftharpoons M(m, n^l, 0) + M(m', n'^{l'}, 1)$ with $M = {}^{14}N_2O$ or $^{12}CO_2$. The rates of these V–V transfers have been measured from room temperature up to 900 K by the laser–induced fluorescence method. These exchanges can play an important role in the kinetics of the fast V–V transfers which occur in gaseous mixtures involving these molecules. This is particularly the case for the transfers occurring between different isotopic species of CO_2 and N_2O, such as $^{12}CO_2$–$^{13}CO_2$, and mixtures of $^{14}N_2O$ with $^{14}N^{15}NO$, $^{15}N^{14}NO$, and $^{15}N_2O$, also studied in this work. The transfer rates for the isotopic mixtures of nitrous oxide have been measured versus temperature. The experimental results are compared with the values calculated on the basis of the long–range multipolar interactions, according to a first–order perturbation theory. (auth)

16021 SPIN–LATTICE RELAXATION IN CROSS RELAXED SYSTEMS: ANISOLE. Cutnell, J.D. (Department of Physics, Southern Illinois University at Carbondale, Carbondale, Illinois 62901); Roeder, S.B.W.; Tignor, S.L.; Smith, R.S. J. Chem. Phys. 62: No. 3, 879-885 (1 Feb 1975).

Spin–lattice relaxation has been monitored as a function of temperature in liquid anisole and its partially deuterated analogues $C_6D_5OCH_3$ and $C_6H_5OCD_3$, as pure liquids and in solution in $C_6D_5OCD_3$. Conventional pulse and Fourier transform techniques have been used. The high resolution spectrum of $C_6H_5OCH_3$ was found to contain three groups of lines, one associated with the methyl protons, one associated with the meta phenyl protons, and one associated with the ortho and para phenyl protons. The two groups of aromatic lines were found to have, within experimental error, identical spin–lattice relaxation times and activation energies. The contribution of intermolecular interactions to the relaxation mechanism was found to decrease with increasing temperature and was $\leq 36\%$ for $T \geq 312°K$. A method is discussed for determining the cross relaxation rate between the differently relaxing methyl and phenyl spins. This method utilizes average T_1 values for $C_6H_5OCH_3$, $C_6D_5OCH_3$, and $C_6H_5OCD_3$ and yields for anisole a positive cross relaxation rate as a function of temperature. The cross relaxation is found to proceed primarily by intramolecular interactions which cause methyl and phenyl spins to flip in the same sense. Correlation times for over–all molecular tumbling are calculated and compared to results from dielectric relaxation experiments. The comparison indicates that the over–all molecular tumbling may be near to the limit of large diffusive steps discussed by Ivanov [Sov. Phys.–JETP 18, 1041 (1964)]. A correlation time for the threefold methyl reorientation is also calculated. Activation energies were found for the species $C_6H_5OCH_3$, $C_6D_5OCH_3$, and $C_6H_5OCD_3$ to be 2.77±0.08, 2.78±0.23, and 3.32±0.26 kcal/mole, respectively. (auth)

16022 THERMAL DIFFUSION IN ISOTOPIC MIXTURES OF POLYATOMIC GASES. II. MODEL CALCULATIONS. Matzen, M.K.; Hoffman, D.K. (Ames Laboratory–USAEC and Department of Chemistry, Iowa State University, Ames, Iowa 50010). J. Chem. Phys. 62: No. 2, 509-514 (15 Jan 1975).

Model calculations are used to study the dependence of the thermal diffusion coefficient on the molecular kinematic parameters for binary, isotopic mixtures of diatomic gases. The effects of a static magnetic field on thermal diffusion are also investigated. The basis of these studies is an analytic expression for D^{T}_{α} previously derived by perturbation techniques. (auth)

16023 VIBRATIONAL DEACTIVATION OF O_3 MOLECULES IN GAS MIXTURES. II. Rosen, D.I.; Cool, T.A. (School of Applied and Engineering Physics, Cornell University, Ithaca, New York, 14850). J. Chem. Phys. 62: No. 2, 466-476 (15 Jan 1975).

Experimental measurements of the rate constants for vibrational deactivation of O_3 by O_3, O_2, CO_2, H_2, D_2, CH_4, N_2, He, Ar, SF_6, CH_3Cl, CH_2Cl_2, CCl_4, and C_2H_2 are presented. Vibrational relaxation of O_3 is shown to follow the sequence (1) rapid $V \rightarrow V$ intermode coupling between the ν_1 and ν_3 modes, (2) a slower coupling of the ν_1, ν_3 modes to the ν_2 mode, and (3) $V \rightarrow T$ relaxation through the O_3(010) level. The results are described in terms of a simple analytic model for vibrational relaxation of O_3. (auth)

16024 THERMAL DIFFUSION IN ISOTOPIC MIXTURES OF POLYATOMIC GASES. I. THE THERMAL DIFFUSION COEFFICIENT. Matzen, M. K.; Hoffman, D. K. (Ames Laboratory–USAEC and Department of Chemistry, Iowa State University, Ames, Iowa 50010). J. Chem. Phys. 62: No. 2, 500-508(15 Jan 1975).

Perturbation techniques are used to derive an analytical expression for the thermal diffusion coefficient for isotopic, polyatomic gas mixtures. The expansions isolate the contributions to the thermal diffusion coefficient which are subject to isotopic variation and elucidate the effect of external fields on the phenomena. (auth)

16025 INFRARED SPECTRUM OF MATRIX–ISOLATED NITRIC ACID. Guillory, W.A. (Department of Chemistry, University of Utah, Salt Lake City, Utah 84112); Bernstein, M.L. J. Chem. Phys. 62: No. 3, 1058-1060 (1 Feb 1975).

The infrared spectra of four isotopic species of matrix–isolated nitric acid have been obtained. The vibrational assignments are in general agreement with previous gas and condensed phase observations with the exception of those assigned to the NO_2 valence bend and NO· single bond stretch. The results of diffusion experiments performed indicate that nitric acid may form cyclic dimers similar to the carboxylic acids. (auth)

16026 MILLIMETER– AND SUBMILLIMETER–WAVE SPECTRUM AND MOLECULAR CONSTANTS OF CUPROUS CHLORIDE. Manson, E.L.; De Lucia, F.C.; Gordy, W. (Department of Physics, Duke University, Durham, North Carolina 27706). J. Chem. Phys. 62: No. 3, 1040-1043 (1 Feb 1975).

Monomeric cuprous chloride (CuCl) has been produced as an intermediate reaction product of copper and chlorine gas at 1000°K. Rotational transitions of $^{63}Cu^{35}Cl$, $^{65}Cu^{35}Cl$, $^{63}Cu^{37}Cl$, and $^{65}Cu^{37}Cl$ have been measured in the millimeter and submillimeter wave region. Transitions have been observed in 7 different vibrational states and for J as high as $32 \rightarrow 33$. Analysis of the data yields the following Dunham and equilibrium coefficients for $^{63}Cu^{35}Cl$: $Y_{01} = 5343.72266(100)$ MHz, $Y_{11} = -30.37285(120)$ MHz, $Y_{21} = 0.06021(46)$ MHz, $Y_{31} = -0.061(50)$ kHz, $Y_{02} = -3.89432(77)$ kHz, $Y_{12} = 0.00234(47)$ kHz, $Y_{03} = -0.0006220(10)$ Hz, $B_e = 5343.768(20)$ MHz, $\omega_e = 417.599(42)$ cm^{-1}, $\omega_e x_e = 1.617(6)$ cm^{-1}; for $^{65}Cu^{35}Cl$: $Y_{01} = 5284.98184(100)$ MHz, $Y_{11} = -29.87340(120)$ MHz, $Y_{21} = 0.05889(46)$ MHz, $Y_{31} = -0.059(50)$ kHz, $Y_{02} = -3.80917(77)$ kHz, $Y_{12} = 0.00227(47)$ kHz, $Y_{03} = -0.0006017(10)$ Hz, $B_e = 5285.026(20)$ MHz, $\omega_e = 415.297(42)$ cm^{-1}, $\omega_e x_e = 1.599(6)$ cm^{-1}; for $^{63}Cu^{37}Cl$: $Y_{01} = 5158.15294(100)$ MHz, $Y_{11} = -28.80453(120)$ MHz, $Y_{21} = 0.05610(46)$ MHz, $Y_{31} = -0.056(50)$ kHz, $Y_{02} = -3.62854(77)$ kHz, $Y_{12} = 0.00214(47)$ kHz, $Y_{03} = -0.0005594(10)$ Hz, $B_e = 5158.195(20)$ MHz, $\omega_e = 410.284(42)$ cm^{-1}, $\omega_e x_e = 1.561(6)$ cm^{-1}; for $^{65}Cu^{37}Cl$: $Y_{01} = 5099.41148(110)$ MHz, $Y_{11} = -28.31388(120)$ MHz, $Y_{21} = 0.05483(46)$ MHz, $Y_{31} = -0.054(50)$ kHz, $Y_{02} = -3.54636(77)$ kHz, $Y_{12} = 0.00208(47)$ kHz, $Y_{03} = -0.0005405(10)$ Hz, $B_e = 5099.453(20)$ MHz, $\omega_e = 407.941(42)$

cm^{-1}. $\omega_e x_e = 1.543(6)\ cm^{-1}$. The Dunham potential constants for cuprous chloride are $a_0 = 244588.0(480)\ cm^{-1}$, $a_1 = -3.21936(32)$, $a_2 = 6.908(26)$, $a_3 = -11.68(23)$, and the equilibrium internuclear distance is $r_e = 2.051177(8)$ A. (auth)

16027 ACETOLYSIS OF (3,5,5,-TRIMETHYL-1-PYRAZOLIN-3-YL)METHYL p-BROMOBENZENESULFONATE. Elimination of Nitrogen from an Azo Compound Via Cationic Intermediates. Allred, E. V.; Flynn, C. R. (Univ. of Utah, Salt Lake City). J. Amer. Chem. Soc.; 97: No. 3, 614-621(5 Feb 1975).

Acetolysis of (3,5,5-trimethyl-1-pyrazolin-3-yl)methyl p-bromobenzenesulfonate (3a) gives a quantitative yield of nitrogen and produces a mixture (100% total yield) of 2,4-dimethyl-4-penten-2-yl acetate, 2,4-dimethyl-1,4-pentadiene, and 2,4-dimethyl-1,3-pentadiene as the only glpc detectable products. The acetolysis kinetics are strictly first order. Comparison of the product and kinetic results with those of model systems indicates that azo compound 3a eliminates nitrogen with accompanying cation formation and that the $-N=N-$ group anchimerically assists ionization. Studies with deuterium labeled reactants 3a-d_6, 3a-d_3, and 3a-d_2 were made to further delineate the mechanistic details. A variety of isotope effect observations provide unequivocal evidence for a stepwise reaction pathway which is characterized by the intervention of a product-determining intermediate after the rate determining step. The results are interpreted in terms of C$-$N bond breaking to give a diazonium ion intermediate which loses nitrogen and forms the 3,4-dimethyl-4-penten-2-yl cation. (auth)

16028 DEUTERIUM EQUILIBRIUM ISOTOPE EFFECTS ON REDISTRIBUTION REACTIONS OF THE METHYLSILANES. Most, J. M. New Brunswick, NJ; Rutgers—The State Univ. (1974). 84p. University Microfilms Order No. 74-27,640.

Thesis (Ph. D.).

Redistribution reactions of both deuterated and undeuterated methylsilanes were examined. The gas phase reactions were catalyzed by aluminum chloride at 50°C, and monitored by means of a fractionation-codistillation analytical system. The redistributions of the undeuterated compounds had previously been examined by Hoffman, but some methods employed in that earlier work are questioned and the results of the present study are considered more reliable. The redistributions studied are characterized by equilibrium constants indicating nonrandom exchange of substituents. ΔH° values calculated from the values of K are consistent with the standard heats of formation of the methylsilanes as recently calculated by Tribble and Allinger. Nonrandom redistributions of substituents are generally attributed to nonzero enthalpy changes. These in turn indicate changes in given bond strengths in going from one compound of a series to another. Appropriate ratios of the equilibrium constants are used to represent isotope exchange reactions: $2\ MeSiH_3 + 3\ Me_2SiD_2 = 2\ MeSiD_3 + 3\ Me_2SiH_2$ [$K_2' = K_2/K_2^* = 0.713 \pm .153$ (K^* refers to reactions of the deuterated compounds)]; $MeSiH_3 + 3\ Me_3SiD = MeSiD_3 + 3\ Me_3SiH$ ($K_3' = 0.667 \pm .133$); $Me_2SiH_2 + 2\ Me_3SiD = Me_2SiD_2 + 2\ Me_3SiH$ ($K_4' = 0.857 \pm .092$). While the equilibrium isotope effects are small, it is demonstrated that this set of exchange constants is internally self-consistent and that entropy effects do not account for the observed trend. This trend suggests that the strengths of the Si$-$H bonds increase in the order $MeH_2Si-H < Me_2HSi-H < Me_3Si-H$. (Diss. Abstr. Int., B)

16029 METAL HYDRIDE REDUCTION OF KETONES: STEREOCHEMISTRY AND KINETICS. Boone, J. R. Atlanta; Georgia Inst. of Tech. (1974). 144p. University Microfilms Order No. 74-30,077.

Thesis (Ph. D.).

The stereochemistry of reduction of selected ketones by a variety of simple and complex metal hydrides, both old and new, has been investigated under identical conditions of solvent, concentration, stoichiometry, temperature and reaction time for comparison purposes. The stereochemical results of these studies are discussed in terms of steric approach control, torsional strain, compression effect, and change in conformation of the ketone. The stereochemistry of reduction of complex aluminohydrides is shown to be dependent on the nature of the cation. Comparison of $LiAlH_4$ and $LiBH_4$ as reducing agents towards ketones shows $LiBH_4$ to be less sensitive to steric interactions. Reduction of 2-methylcyclohexanone with $ClMgAlH_4$ and $Mg(AlH_4)_2$ gave results best explained by assuming complexation of the carbonyl oxygen by magnesium followed by a change in the conformation of the ketone (methyl group equatorial to axial). Results obtained from reduction studies of substituted cyclopentanones and cis-2-methyl-4-tert-butylcyclohexanone do not suggest the presence of a compression effect in metal hydride reductions. A study of the reduction of ketones by $LiAl(OR)_3H$ compounds shows the stereochemistry to be independent of concentration. The stereochemistry of reduction of ketones by $LiAlH_4$ and $LiAlD_4$ is similar. Pseudo first order kinetic studies on the reaction of $LiAlH_4$, $NaAlH_4$ and $LiAlD_4$ with mesityl phenyl ketone have been carried out in tetrahydrofuran at 25°. The reactions were carried out in excess hydride and found to be first order in hydride and first order in ketone. $LiAlH_4$ is about ten times more reactive than $NaAlH_4$ which indicates the importance of the cation in the mechanism of the reaction. A deuterium kinetic isotope study involving the reaction of $LiAlH_4$ and $LiAlD_4$ with mesityl phenyl ketone gave a value of k_H/k_D of 1.27 which implicates the transfer of the hydride from aluminum to the carbonyl carbon in the rate determining step of the reaction. Aluminum hydride is about ten times less reactive than $LiAlH_4$ in the reduction of mesityl phenyl ketone. (Diss. Abstr. Int., B)

16030 HYDROGEN BOND STUDIES. XCII. Disorder in $(HCO_3)_2^{2-}$ AND $(DCO_3)_2^{2-}$ DIMERS: A NEUTRON DIFFRACTION STUDY OF $KHCO_3$ AND $KDCO_3$. Thomas, J. O.; Tellgren, R.; Olovsson, I. (Umeaa Univ., Sweden). Acta Crystallogr., Sect. B; 30: No. 11, 2540-2549(15 Nov 1974).

Three-dimensional single-crystal neutron-diffraction data sets have been collected for $KHCO_3$ and $KDCO_3$ at 298°K. Both unit cells are monoclinic, space group $P2_1/a$, containing four formula units. The cell dimensions are, for $KHCO_3$: a = 15.1725 (11), b = 5.6283 (5), c = 3.7110 (4) Å, $\beta = 104.631\ (6)^0$, V = 306.62 $Å^3$; and for $KDCO_3$: a = 15.1948 (9), b = 5.6307 (3), c = 3.7107 (3) Å, $\beta = 104.567\ (5)^0$, V = 307.27 $Å_3$. The structures comprise K^+ ions and centrosymmetric $(HCO_3)_2^{2-}$ dimers. Contrary to earlier x-ray findings, the H (and D) atoms of the dimers occupy two possible sites in the hydrogen bonds in the rough proportions 4 : 1; the dimers as a whole must therefore also be subject to the same degree of disordering. The conventional R values for the final refinements of a model in which only the H (and D) atoms occupy disordered sites are 0.033 and 0.040, respectively. The corresponding 0...0 hydrogen-bond within the $(HCO_3)_2^{2-}$ and $(DCO_3)_2^{2-}$ dimers are 2.587 (1) and 2.607 (2) Å, respectively. (auth)

Isotope Exchange and Isotope Separation

16031 METHOD FOR IMPROVING EFFICIENCY IN THE PHOTOCHEMICAL SEPARATION OF ISOTOPES. Basov, Yu. G.; Makarov, V. N. Sov. At. Energy (Engl. Transl.); 36: No. 6, 662-664(Jun 1974).

Translated from At. Energ. (USSR); 36: No. 6, 522-523(Jun 1974).

Application of a method, based on the selective excitation of oscillation levels of molecules with infrared laser radiation, for improving the efficiency of the photochemical separation of isotopes by means of gas-discharge light sources is discussed. Separation of the stable isotopes of hydrogen is used as an example. Results show that in order to increase the efficiency of photochemical isotope separation, the relative amount of shortwave radiation in the light flux must be reduced down to the wavelengths corresponding to the photo dissociation energy of the heavy isotope molecule. (LK)

16032 INFLUENCE OF THE STRUCTURE OF A NICKEL SURFACE ON ITS CATALYTIC BEHAVIOUR IN THE HYDROGEN ISOTOPE EXCHANGE. Levina, S. D.; Astakhov, I. I.; Surikov, V. V. Elektrokhimiya; 10: No. 4, 648-649(Apr 1974). (In Russian).

An electron-microscope study was made of the surface of a Ni catalyst prepared in two ways: (1) by heating in O at 100°C and subsequently in H at 250°C, and (2) after simply heating in H at 250°C. Prior oxidation of the Ni gave a finely divided surface with finely crystalline Ni and strongly developed grains, differing from the surface produced solely by H reduction which had a smooth texture. The data indicates that the activation of Ni for the isotopic exchange of H is probably connected with a lowering in the electronic work function of the surface. (Metals Abstr.)

16033 HYDROGEN-DEUTERIUM EXCHANGE IN 2-THIABICYCLO[2.2.1]HEPTANE DERIVATIVES. Folli, U.; Iarossi, D.; Moretti, I.; Taddei, F.; Torre, G. (Univ. of Modena, Italy). J. Chem. Soc., Perkin Trans., II; No. 14, 1655-1658(1974).

The rate constants for deuterium exchange of protons α to the sulphinyl or sulphonyl group in 2-thiabicyclo[2.2.1] heptane derivatives were determined in MeONa-MeOD at 100°. Electronic and steric effects on the facility of carbanion formation in these systems and the stereochemistry of exchange are discussed. (auth)

16034 STEREOCHEMISTRY OF HYDROGEN-DEUTERIUM EXCHANGE α TO THE SULPHINYL GROUP IN 2 H-NAPTHO-[1,8-bc] THIOPHEN DERIVATIVES. Folli, U.; Iarossi, D.; Taddei, F. (Univ. of Modena, Italy). J. Chem. Soc., Perkin Trans., II; No. 14, 1658-1662(1974).

The rate of deuterium exchange in MeONa-MeOD of α-protons having an equal stereochemical relation to a sulphinyl group was found to follow an opposite trend in 2H-naphtho[1,8-bc]thiophen derivatives to that previously observed in 2-thiabicyclo[2.2.1] heptane derivatives and for which tetrahedral α-sulphinyl carbanions of different stability had been proposed as intermediates in the exchange process. The experimental results were rationalized by assigning to tetrahedral and planar α-sulphinyl carbanions a separate role in determining, according to their relative stability, the rate of proton abstraction or the stereochemistry of the exchange, or both. (auth)

16035 ISOTOPIC EXCHANGE OF BROMINE IN AQUEOUS SYSTEM: CIS-DIBROMODIAMMINEPLATINUM(II), TETRABROMOPLATINATE(II), BROMIDE. Vandergrift, G. F. III; Martin, D. S. Jr. (Ames Lab., IA). Inorg. Chim. Acta; 12: No. 2, 179-186(Feb 1975).

The aquation equilibria for cis-dibromodiammine-platinum(II) have been measured. For the first and second aquations at 25°C: K_1 = 1.13 mM. $\Delta H^\circ = 3.9 \pm .7$ kcal/mol, K_2 = 0.042 mM, $\Delta H^\circ = 10 \pm 3$ kcal/mol. Some isotopic exchange of ^{82}Br between c-Pt $(NH_3)_2Br_2$ and $PtBr_4^{2-}$ occurs without the formation of a free bromide ion and with a rate expression: rate exchange = $(k_{ac}' + k_{ac}''/[Br^-])[Pt(NH_3)_2Br_2]\ [PtBr_4^{2-}]$. It has been shown that the presence of c-$Pt(NH_3)_2Br(H_2O)^+$ serves to catalyze the aquation of $PtBr_4^{2-}$, but that the catalysis step does not account for all the bromide dependent exchange. (auth)

16036 DEPENDENCE OF THE RATE OF ELECTROPHILIC DEUTERIUM–HYDROGEN EXCHANGE ON THE DONOR–ACCEPTOR INTERACTION OF THE COMPONENTS OF THE REACTION MIXTURE. Serebryanskaya, A. I.; Maksimova, P. A.; Shatenshtein, A. I. (Physical-Chemical Inst., Moscow). J. Gen. Chem. USSR (Engl. Transl.); 44: No. 7, 1576-1580(Jul 1974).

Translated from Zh. Obshch. Khim.; 44: No. 7, 1607-1613 (Jul 1974).

Rate constants were measured for the deuterium–hydrogen exchange reactions of N,N-dimethylaniline-p-d with acids of different strengths (CF_3COOH and CH_3COOH) and of 1,3,5-trimethoxybenzene-2,4-6-d_3 with CH_3COOH in aprotic solvents differing in their polar and electron-donor properties. In the first reaction the concentrations of the acids were varied. Ultraviolet spectra were measured for solutions of N,N-dimethylaniline in hexane or benzene with trifluoroacetic acid and additions of tetrahydrofuran or dimethyl sulfoxide. The more powerfully electron-donating the added compound, the lower the concentration of the latter at which a given degree of dissociation of the n complex of the amine with the acid is attained. The rates of these liquid-phase electrophilic deuterium–hydrogen exchange reactions are greatly influenced by the formation of donor–acceptor complexes between components of the reaction system, the stabilities of the complexes, and competition between complex-formation equilibria. (auth)

16037 CHROMATOGRAPHIC ISOTOPE EXCHANGE COLUMNS. Nakhutin, I. E.; Rubeznyi, Yu. G.; Smirnova, N. M.; Loshakov, G. A.; Vezirov, V. N. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 4, 560-562(Apr 1974).

Translated from Zh. Fiz. Khim.; 48: No. 4, 973-975(Apr 1974).

The distribution of radioactive methyl iodide in isotope exchange columns with PbI_2 has been investigated. The marked dependence of the purification coefficient on the methyl iodide concentration is in qualitative agreement with theory. The AgI–$AgNO_3$ mixture, the composition of which depends on the NO_2 and I_2 concentrations in the gas phase, exists at equilibrium in the NO_2–O_2–AgI–$AgNO_3$ system. Accordingly the purification coefficient of I_2 in a column with AgI should depend on the NO_2 concentration and on temperature. (auth)

Feed Materials Processing

Refer also to abstracts 17025 and 17067.

16038 (AAEC/LIB/Bib–431) CARBONATE LEACHING OF URANIUM ORES AND PROCESSING OF CARBONATE LEACH LIQUORS. A Bibliography. McDonald, C. J. (comp.). (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Oct 1974. 76p. Dep. NTIS (US Sales Only) $7.00.

A bibliography of 280 references covering the period from 1950 to 1974 was compiled. The bibliography is arranged alphabetically by author and chronologically by year. (JSR)

16039 (DOCKET-406622-6) SHIRLEY BASIN URANIUM MILL. AEC Final Environmental Statement. (Utah International, Inc., San Francisco, Calif. (USA)). Dec 1974. 398p. Dep. NTIS $23.00.

Information is presented in support of operation of a uranium mill in the Shirley Basin area of Carbon County, Wyoming. The mill is designed as an acid-leach, resin ion-exchange uranium ore processing plant with a design capacity of about 1500 to 1800 tons of ore per day. The environmental impact of the combined mining and milling project is considered. The activities cause a temporary (~13–15 y) reassignment of use of about 8700 acres of land. Approximately 19 million pounds of uranium concentrates will be produced over a period of about 12 years. A stabilized tailings pile covering 232 acres involving 3.5 million tons of tailings will be created. Major alternatives considered are discussed. (MCG)

Radiation Chemistry

Refer also to abstracts 16096, 16517, 16704, 17562, and 19119.

16040 (AED-CONF–74-406-002) THE BEHAVIOUR OF HIGH POLYMERS UNDER THE INFLUENCE OF IONIZING RADIATION. Wilski, H. (Farbwerke Hoechst A. G., Frankfurt am Main (F. R. Germany)). 1974. 16p. (In German). INIS.

From 38th meeting of physicists' of the Deutsche Physikalische Gesellschaft e. V.; Nuernberg, F. R. Germany (23 Sep 1974).

16 figs.; 14 refs. Available from ZAED.

With regard to the behavior of high polymer materials under the influence of ionizing radiation, the resulting reactions and charges were investigated. At moderate radiation doses, relatively few chemical reactions are set off per gram, but as the molecular weight of high polymers are very high (10^5 to 10^6 g/Mol), this means many reactions per molecule and thus lasting changes of the physical properties. (GE)

16041 (CEA-CONF–2707) USE OF DIFFERENT TYPES OF RADIATION IN THE MANUFACTURE OF MEMBRANES. Marchand, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Div. de Chimie). 1974. 8p. (In French). (CONF-740568–2). Dep. NTIS (US Sales Only) $4.00.

From 1st world congress on filtration; Paris, France (14 May 1974).

Radiochemical grafting was used to manufacture semi-permeable membranes. With γ radiation, batches of polyelectrolyte are housed in the texture of a crystalline polyester film or in the mass of a porous silicone elastomer. Ionizing heavy particles give a porous material with cylindrical pores of diameter governed by the etching conditions. If in the latter case the species created by the passage of ionizing particles is used to fix a polyelectrolyte, this is found after pore formation to be distributed in the walls of the pores. (FR)

16042 (CEA-CONF–2708) PRESENT RESEARCH ON THE USE OF RADIATIONS IN CHEMISTRY. Modified Polymer: Applications. Gaussens, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Centre d'Application et de Promotion des Rayonnements Ionisants). 1974. 16p. (In French). (CONF-740487–1). Dep. NTIS (US Sales Only) $4.00.

From conference of instruction on new plastic materials; Paris, France (22 Apr 1974).

The chemical composition and different means of synthesis of radiohardenable polymers are examined and methods of obtaining grafted polymers are reviewed. Some examples of the application of methods using ionizing radiations are given (grafted polyethylene, grafting applied to textiles, irradiation of paints and varnishes). The different irradiation facilities available on the market and their fields of application are presented. (FR)

16043 (COO-913-53) CONTRIBUTION OF ELECTRONICALLY EXCITED STATES TO THE RADIATION CHEMISTRY OF ORGANIC SYSTEMS. Progress Report, November 1, 1972–October 31, 1973. Lipsky, S. (Minnesota Univ., Minneapolis (USA)). [nd]. Contract AT(11-1)-913. 8p. Dep. NTIS $4.00.

Fluorescence spectra and fluorescence quantum yields have been obtained from upper excited states of benzene, toluene, p-xylene, naphthalene, and pyrene. Measurements have been made both in the vapor and liquid phases. Nonradiative rate constants of the order of 10^{14} sec^{-1} have been calculated from the quantum yields and absorption strengths. Emission from cyclohexane and bicyclohexyl solids has been found to critically depend on their crystalline structure. For cyclohexane the emission spectrum suddenly blue-shifts on cooling below its solid-solid phase transition temperature. For bicyclohexyl there is a sharp discontinuity in its emission quantum yield and blue shift in its spectrum on cooling below a heretofore unreported phase transition at ~0°C. The results are consistent with a partial Rydberg nature of the excited cycloalkane state. Weak fluorescence has been observed from a number of simple olefins in the region from 230-260 nm, both in vapor and solution phases. Quantum yields and spectra are being determined. The transitions are tentatively assigned as originating from the lowest singlet Rydberg state. (auth)

16044 (COO-913-59) CONTRIBUTION OF ELECTRONICALLY EXCITED STATES TO THE RADIATION CHEMISTRY OF ORGANIC SYSTEMS. Progress Report, November 1, 1973—October 31, 1974. Lipsky, S. (Minnesota Univ., Minneapolis (USA)). [nd]. Contract AT(11-1)-913. 8p. Dep. NTIS $4.00.

G values were determined for the production of the lowest excited singlet states of seven saturated hydrocarbon liquids by direct measurement of the neat liquid fluorescence. Comparison with reported results obtained via a solute sensitization technique indicate that the solute technique may strongly underestimate the true G value. The fluorescence of liquid bicyclohexyl excited both with β particles and 184.9 nm light has been studied as a function of concentration of perfluorocarbon scavengers. The results permit estimates of (a) the fraction of all excited singlet states that derive from geminate ion pairs and (b) the probability that a geminate pair will generate an excited singlet state on recombination. A weak fluorescence has been observed from nine mono-olefinic hydrocarbons excited at 184.9 nm in vapor and/or liquid phases. Emission spectra and quantum yields have been obtained. For tetramethylethylene, additional studies have been made on effects of excitation wavelength, of quenchers and of solution in low-temperature matrices. A possible Rydberg assignment for the emission is considered. Electron impact spectra were obtained for eight saturated hydrocarbons at a scattering angle of 0°C and an impact energy of 50 eV. Close agreement is obtained with spectra reported at higher energies and with optical spectra. (auth)

16045 (IAEA-R-794-F) USE OF NUCLEAR TECHNIQUES AND TECHNOLOGY FOR THE STUDY OF THE MICRO-ECOSYSTEM AND FOR THE IMPROVEMENT OF THE BIOSPHERE RESOURCES. Part of a Coordinated Programme of Research on the Study and Improvement of Biosphere Resources. Final Report, 15 October 1969–14 October 1972. Altmann, H. (International Atomic Energy Agency, Vienna (Austria)). Jan 1973. 5p. INIS.

The efficacy of the nuclear tools and techniques for sterilizing sewage from industrial and domestic origin was studied. Research under this project also attempted to identify, with the help of nuclear techniques, the occurrence, fate, and biologic consequences of heavy metallic elements and their organic derivatives (e.g. methylmercury) as pollutants in ecosystems. One major part of this project involved in study of the radiation responses of the microorganism occurring in the different sewage samples. Studies on Chlorella pyrenoidosa, a species of common occurrence in sewage ponds, indicated that the cellular stage immediately prior to DNA synthesis (i.e. late in G_1) was most radiosensitive, while the sporulation stage was most radioresistant. The cells showed a high capacity for repair of damages induced by radiation exposures. DNA damages following a dose of 100 krad of gamma rays were repaired within 30 minutes of post-irradiation interval. However, the data showed that following the exposure to radiation dose as high as 500 krad delivered at a high dose rate (500,000 rad/hr) the repair of the induced DNA damages was very poor. With respect to investigations on heavy metal pollutants the mercury concentration in the sludge samples from an isolated lake (Neusiedlersee) in Austria was in the range of 10 parts per billion (ppB) while the fish samples from that lake showed ten fold or more mercury concentration. This seems to indicate an accumulation of mercury by the food chain. The gamma spectra of irradiated sludge samples (neutron activation analysis) showed a hazardously high concentration of some other heavy metallic elements in the sludge samples from that lake. Further studies are underway by the group on this field of environmental research. (INIS)

16046 (IEA–347) ELECTRON PARAMAGNETIC RESONANCE OF X-IRRADIATED TYROSINE, THYRONINE, AND THEIR IODINE-DERIVATIVES. Crippa, P. R.; Loh, E.; Isotani, S. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Jun 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

The electron paramagnetic resonance of x-irradiated (~10 krad) tyrosine, thyronine, and their iodine-derivatives in the form of compressed pellets in vacuum-sealed quartz tubes were measured between 100 and 300°K at ~9 G Hz. The EPR spectra of tyrosine, 3-5 diiodothyronine, and thyronine, in the order of decreasing line-width, are spectrally similar and hence indicate that the electron spin density, $g = 2.004$ or 2.005, is trapped mainly in the ring from which the hydroxyl proton is lost. The samples having iodine on the same ring as the OH group show a rather large anisotropy in $g \approx 2.04$ presumably due to the presence of small spin density on the iodine(s). The G_r value, i.e., the number of paramagnetic centers produced by 100 eV as deduced from the temperature dependence of the magnetic absorption, of the irradiated iodine-derivatives increases with the number of iodines on the molecule. The G_r values of tyrosine and thyronine, however, can not be estimated from the magnetic absorptions, since their absorption increases with the temperature indicating the antiferromagnetic exchange between spin densities on the neighboring molecules. (auth)

16047 (NP-20273) TRANSPORT OF RADIATION-INDUCED CHARGE CARRIERS IN LIQUID ALKANES. Chandrasekaran, T. (Maryland Univ., College Park (USA). Dept. of Chemical Engineering). 1974. 124p. University of Maryland, College Park, MD.

Thesis.

The transport of radiation-induced charge carriers in liquid alkanes was analyzed in zero external electric field to study the electron scavenging process and the time dependent decay of scavenger anions; the model system chosen for the study is cyclohexane containing biphenyl as the scavenger. For this purpose, Monchick's equation describing the scavenging kinetics for various scavenger concentrations, C_s, was solved numerically to obtain the spatial distribution of electron-cation pairs at different times and the total scavenger anion yields. Calculations were performed using the exponential, Gaussian, and delta function initial distributions of the electron-cation pairs. The exponential distribution provides the best fit of calculated values over the widest range of experimental results. All three initial distributions give equivalent results for $C_s < 10^{-3}$ moles/l^{-1}. The time-dependent yields of the biphenylide anion were obtained using a two group model that treats the kinetics of recombination for the spatially correlated ion pairs separately from those of the ion pairs whose members escape each other (free ion pairs). Calculations were performed using the delta function distribution for three different initial separation distances of the ion pair, namely, 80, 82, and 84 Å. The decay yields for 82 Å give good overall agreement with experimental measurements of the decay yields of the biphenylide anion for the time after formation of the pair ranging from 100 nsec to one μsec. The time dependent yields of the spatially correlated ion pairs vary approximately inversely as the square root of time at long times. The transient transport problem of an isolated ion pair in the presence of an external electric field was analyzed by solving numerically Smoluchowski's equation in the presence of an external electric field for the case of a delta function initial distribution of ion pairs for the following field strengths: 10, 30, 50, 70 and 100 kV/cm^{-1}. Several useful results, such as the surviving fraction of cation-anion pairs in irradiated biphenyl-cyclohexane solutions as a function of time and field strength, the asymptotic limits of the yields, the time for reaching these limits and the spatial distribution of the ion pairs as a function of their orientation to the direction of the external field were obtained from the analysis. The time it takes to reach the asymptotic limit of the yield (free ion yield) ranges from ~24 nsec to ~1 μsec for fields ranging from 100 to 10 kV/cm^{-1}, respectively. The asymptotic yields obtained for all the electric fields are in good agreement with the free ion yields calculated by using Onsager's solution of the steady-state problem. (auth)

16048 (NP-20274) RADIATION-INDUCED GRAFTING OF HEXAFLUOROACETONE TO POLYETHYLENE. Clark, C. F. (Maryland Univ., College Park (USA)). 1974. 62p. University of Maryland, College Park, MD.

Thesis.

Although hexafluoroacetone is not polymerized by ionizing radiation, it is shown that gamma irradiation of hexafluoroacetone dissolved in polyethylene films produces a graft with a kinetic chain length of more than 100. The effects of dose rate (0.021-3.55 Mrad/hr) and temperature (21-53°C) on the graft rates were measured. The effects of temperature (21 to 53°C) on the post-grafting and on the physical properties of the grafted films were also investigated. Based on these results and solubility, infrared, and EPR data, a mechanism is postulated. (LK)

16049 (ORO-3606-43) PRINCIPAL PROCESSES IN THE RADIOLYSIS OF GASES BY HIGH ENERGY ELECTRONS AND FISSION RECOILS. Annual Progress Report, October 1, 1973–September 30, 1974. Meisels, G. G. (Houston Univ., Tex. (USA). Dept. of Chemistry). Sep 1974. Contract AT(40-1)-3606. 16p. Dep. NTIS $4.00.

A detailed analysis of competition between a temperature-dependent radical addition process to ethylene and radical combination in the fission recoil radiolysis of ethylene suggested that track temperature in that compound at a density of 0.065 g/cm^3 may be as high as 200 to 300°K above ambient. The absence of a density dependence of nitrogen yields in the fission recoil radiolysis of nitrous oxide indicates with less reliability that temperatures remain at values not much more than 50° above ambient at similar densities of N_2O. The combined effects of sulfur hexafluoride and trimethylamine on the yields of butenes in the fission radiolysis of ethylene were shown to be consistent with the action of the former additive as an ion-life extender, and have led to an estimate of $G(C_2H_4^+) \geq -1$/ion/100 eV. Ion densities were found to be on the same order of magnitude or somewhat smaller than those of free radicals at comparable densities. Careful dosimetry and repeated experiments have established that the yield of CO from CO_2 reaches 8 ± 0.9 molecules/100 eV in the absence of additives and 10 ± 1 molecules/100 eV in the presence of 4% or more nitrous oxide. Side reactions leading to nitrous oxide destruction appear to be relatively minor. The resulting efficiency for converting fission recoil energy deposited outside the fuel foil to chemically stored energy is ~28%. While this quantity is reduced because some fission recoil energy is expended within the foil, the accompanying fast neutron and gamma irradiation offsets this loss to some extent and leads to an overall fission energy conversion efficiency on the order of 15 to 20%, suggesting the possible utility of a dual-purpose reactor for peaking and production of gaseous fuel. Further conversion of CO to H_2 using the shift reaction would reduce overall efficiency to 12 to 16%. Mass spectrometric measurements have shown that the dominant mechanism of O^- formation in CO_2 is electron capture by atomic oxygen, a process with which SF_6 interferes efficiently. Also obtained were thermodynamic data for protonated species in the CO_2/CH_4 system. (auth)

16050 ANALYSIS OF EPR SPECTRA OF RADICALS FORMED IN GAMMA RADIOLYSIS OF AMMONIA ADSORBED ON DISPERSED SILICAS. Kartel, N. T.; Lobanov, V. V.; Strelko, V. V. (Inst. of Physical Chemistry, Kiev). Teor. Eksp. Khim.; 10: No. 5, 645-652(1974). (In Russian).

The products formed in gamma radiolysis of ammonia adsorbed on silica sorbents (silica gel and aerosils) were studied. Interpretation of the EPR spectra and quantum-chemical calculations led to the conclusion that $\equiv Si\dot{N}H$ radicals, formed from surface $\equiv SiNH_2$ groups, result from chemical reaction of ammonia with the silicon surface and must be considered in the calculations. (tr-auth)

16051 RADIATION-INITIATED POLYMERIZATION OF STYRENE IN THE LIQUID ONE SOLID STATES. Westlake, J. F. Waterloo, Ont.; Univ. of Waterloo (1971). 226p. Thesis.

The results of the present study indicate that the radiation-initiated polymerization of styrene in the liquid state may proceed simultaneously via a free radical and an ionic mechanism, specifically a cationic mechanism. In order to account for the observed experimental findings, a comprehensive reaction scheme has been developed which allows for polymerization by a free radical, cationic, or radical-cationic species, or a combination of all three, depending upon experimental conditions. Substitution of determined values for the rate constants and G values results in good agreement between theoretically generated and experimentally determined kinetic data and molecular weight distribution data over the range of experimental conditions studied. Results obtained for the solid state polymerization of styrene demonstrate that at least two distinct mechanisms are responsible for the observed polymerization. From analysis of kinetic and molecular weight distribution data, these mechanisms have been identified as cationic and radical (or radical-cationic) in nature. The presence of small quantities of oxygen appears to have no appreciable effect on either the kinetics of reaction or the resulting molecular weight distributions. Finally, a reaction scheme has been proposed to account for the apparent insensitivity of the cationic mechanism to the conditions of polymerization. (auth)

16052 WALL EFFECT ON HYDROGEN FORMATION IN THE VAPOR-PHASE RADIOLYSIS OF c-C_6D_{12} AND n-C_7D_{16}. Fujisaki, N.; Gaumann, T. (Federal School of Tech., Lausanne). Helv. Chim. Acta; 57: No. 7, 2091-2098(6 Nov 1974).

Vapor-phase radiolysis of c-C_6D_{12} and n-C_7D_{16} leads to a relatively large HD yield, up to ~20% of the total hydrogen, which cannot be accounted for by incomplete deuteration of c-C_6D_{12} and n-C_7D_{16}. In order to elucidate the mechanism of the HD formation, the effects of additives and of physical conditions on the HD yield were examined. By coating the vessel with a layer of Aquadag the HD yield is greatly decreased without appreciable variation of the total hydrogen yield. The HD yield from nontreated vessels also decreased remarkably with increasing total dose; it is increased on the addition of traces of water; and is less affected by small amounts of c-C_6H_{12}. The addition of SF_6 selectively reduces the HD yield. These experimental results lead to the conclusion that inert hydrocarbon ions react by proton transfer with water desorbed from the vessel wall to give hydronium ions which yield HD on subsequent neutralization. (auth)

16053 ACCELERATED RADIATION POLYMERIZATION OF VINYL–DIVINYL COMONOMER SYSTEMS. Part I. Methyl Methacrylate-Tetraethylene Glycol Dimethacrylate. Micko, M. M.; Paszner, L. (Univ. of British Columbia, Vancouver). J. Radiat. Curing; 1: No. 3, 3-8(Jul 1974).

Many common vinyl monomers, such as methyl methacrylate (MMA), are so insensitive to radiation polymerization that continuous radiation processing of wood, veneer, or paper polymer composites is impractical. However, addition of as little as 5 to 10 percent of divinyl monomer, acting as crosslinking agent, can accelerate the radiation curing process and thus lower the dose required for cure to as little as one-third of that needed for the pure (MMA). The accelerating ability of commercially available tetraethylene glycol dimethacrylate (TEGDMA) and its ability to cause early onset of Gel Effect Point (GEP) in the γ-irradiated MMA-TEGDMA system was studied over the full concentration range. Improvement in the individual polymerization parameters, as evaluated from polymerization exotherm curves, were related to concentration of crosslinking agent in the system. (auth)

16054 STYRENE IMPREGNATED, ^{60}Co IRRADIATED, GRAPHITE ELECTRODE FOR ANODIC STRIPPING ANALYSIS. Clem, R. G.; Sciamanna, A. F. (Univ. of California, Berkeley). Anal. Chem.; 47: No. 2, 276-280(Feb 1975).

A description is given of an electrode for anodic stripping voltammetry prepared by polymerizing and crosslinking the styrene impregnator to the graphite with γ radiation from a 5000-Ci, ^{60}Co source. Electrodes prepared by this process have performed, anomaly-free, in neutral and slightly acid solutions for over 6 months. In acid solutions at pH 1 to 2, the electrode is viable for several days. Reasons for premature electrode failure in acidic solutions are offered and future areas of work are suggested. (auth)

16055 USE OF RADIATION-INDUCED POLYMERS TO INHIBIT THE INTRUSION OF CONTAMINATING FLUIDS INTO RESERVOIRS. Knight, B. L.; Rhudy, J. S.; Gogarty, W. B. (to ACA America Inc.). US Patent 3,830,298. 20 Aug 1974. Filed date 6 Nov 1972. 12p.

Intrusion of contaminating fluids, e.g. salt water, into a fresh water aquifer is inhibited by injecting into the aquifer, preferably in advance of the intruding fluids, an aqueous solution containing a polymer obtained as a product of radiation-induced polymerization of acrylamide and/or methacrylamide and acrylic acid, methacrylic acid, and/or alkali metal salts thereof. The polymerization is preferably carried out in 10 to 60% aqueous monomer solution with gamma radiation. A mixture of monomers, before radiation, preferably contain 25 to 99% acrylamide and 75 to 100% sodium acrylate. The polymer can be positioned within the aquifer by withdrawing fluids therefrom. The properties of the polymer permit "plugging" of the reservoir rock in advance of the contaminating fluids. (Official Gazette)

16056 UNSTABLE INTERMEDIATES. CL. Nitrogen Dioxide, Nitrogen Trioxide, and Nitrate (2-1) in Irradiated Lead(II) Nitrate: Electron Spin Resonance Evidence for Electron Transfer to and from Lead(II) Ion. Symons, M. C. R.; West, D. X.; Wilkinson, J. G. (Univ. of Leicester, Eng.). J. Chem. Soc., Dalton Trans.; No. 20, 2247-2254(1974).

All three of the title radicals have ESR spectra that display satellite lines assignable to ^{207}Pb hyperfine components. The radical NO_3^{2-} interacts strongly with three magnetically equivalent Pb^{2+} ions and weakly with a fourth. The hyperfine coupling is anisotropic, suggesting the acquisition of spin density by the 6p manifold. This is supported by the large shift to high field for the NO_3^{2-} features, compared with results for this species in alkali-metal salts. Single-crystal studies show that the principal directions of the ^{207}Pb hyperfine-tensor components are strongly displaced from those of the ^{14}N hyperfine tensor and hence various anomalous features of the powder spectrum are interpreted. A radical, thought to be NO_3, is also formed by ^{60}Co γ rays at 77°K. This also displays a large shift to high field (low g values) relative to "normal" NO_3, and strong, almost isotropic, hyperfine coupling to three neighboring Pb^{2+} ions. This species is stationary at 4.2°K, but exhibits in-plane rotation at 77°K and free rotation at ca. 200°K. On storage at room temperature it is slowly replaced by a species with normal magnetic properties for NO_3 and no detectable coupling to ^{207}Pb nuclei. At room temperature, features for NO_3^{2-} also decay, being replaced by those characteristic of NO_2 undergoing in-plane rotation. This exhibits isotropic coupling to three equivalent Pb^{2+} ions. On cooling at 77°K, the radicals become stationary on the ESR time scale and exhibit strong, almost isotropic, coupling to a single Pb^{2+} ion and weak coupling to two other ions. These results are discussed in the light of the ability of Pb^{2+} to act both as an electron donor and acceptor. (auth)

16057 UNSTABLE INTERMEDIATES. CXLIX. An Electron Spin Resonance Study of Various Phosphinyl Radicals Formed by Solid-State Radiolysis. Fullam, B. W.; Mishra, S. P.; Symons, M. C. R. (Univ. of Leicester, Eng.). J. Chem. Soc., Dalton Trans.; No. 20, 2145-2148(1974).

One of the major products when a range of trivalent phosphorus compounds was exposed to ^{60}Co γ rays at 77°K was shown by ESR spectroscopy to be the corresponding phosphinyl radical, $\dot{P}R_2$. These radicals, which include $\dot{P}H_2$, $\dot{P}(Me_2CH)_2$, $\dot{P}(OMe)_2$, $\dot{P}(SMe)_2$, $\dot{P}Ph_2$, $\dot{P}Ph(Cl)$, and $\dot{P}Cl_2$, are all characterized by a ^{31}P parallel hyperfine coupling constant in the 240 to 290 G range and a perpendicular coupling close to zero. The conditions under which these radicals are formed, and the mechanisms involved, are outlined and discussed. (auth)

16058 ELECTRON SPIN RESONANCE DETECTION OF RS RADICALS IN IRRADIATED SOLIDS. Radicals of Type RSSR-, $RS-SR_2$, and $R_2SSR_2^+$. Symons, M. C. R. (Univ. of Leicester, Eng.). J. Chem. Soc., Perkin Trans., II; No. 13, 1618-1620 (1974).

It is suggested that radicals previously identified as RS, having g tensor components in the 2.002, 2.025, and 2.060 regions are better described as $RS\text{-}SR_2\sigma^*$ radicals, structurally similar to the established radical anions, $RS\text{-}SR^-$. Furthermore, a radical in irradiated thiodiglycolic acid previously thought to be $(HO_2CCH_2)_2\dot{S}^+$ is almost certainly the dimer-cation $(HO_2CCH_2)_2\dot{S}-S(CH_2CO_2H_2)^+$. The type of spectrum expected for $R\dot{S}$ radicals including $H\dot{S}$ is discussed, together with possible assignments. (auth)

16059 ELECTRON PARAMAGNETIC RESONANCE STUDY OF THE $(\Phi NH)_2P^\cdot$ RADICAL TRAPPED IN A DIPHENYL PHOSPHONDIAMIDE MONOCRYSTAL IRRADIATED WITH X RAYS. Ginet, L.; Geoffroy, M. (Univ., Geneva). Helv. Chim. Acta; 57: No. 6, 1761-1765(1974). (In French).

The radical $(\Phi NH)_2P\cdot$ is trapped by annealing at 100°C an x-irradiated single crystal of N−N diphenyl phosphondiamide and has been studied by electron spin resonance. The isotropic and anisotropic ^{31}P coupling constants are discussed. The principal values and direction cosines of the g tensor are also given. · (auth)

16060 STUDY OF PEROXIDASE MECHANISMS BY PULSE RADIOLYSIS. II. Reaction of Horseradish Peroxidase Compound I with O^{2-}. Bielski, B. H. J. (Brookhaven National Lab., Upton, NY); Comstock, D. A.; Haber, A.; Chan, P. C. Biochim. Biophys. Acta-Enzymol.; 350: No. 1, 113-120(May 1974).

Sodium formate has no effect upon the absorption spectra and the rates of reaction of horseradish peroxidase (donor: H_2O_2 oxidoreductase, EC 1.11.1.7) and its derivative Compound I. It is a good radiation protector for horseradish peroxidase in aerated aqueous solutions. The rate of formation of Compound I has been determined in a fast kinetics spectrophotometer at 335 nm. During the conversion of horseradish peroxidase to Compound I, no other intermediates are detectable in the range from 300 to 450 nm. Radiation-generated superoxide radicals (O_2^-), reduce Compound I to Compound II with a rate constant of $1.60 \cdot 10^6 \pm 0.08 \cdot 10^6$ M^{-1} s^{-1}. A three-dimensional computer presentation (absorbance vs wavelength vs time) shows spectral changes observed after pulse irradiation of an air-saturated formate solution containing horseradish peroxidase. Studies with both pulse radiolysis and gamma-ray irradiation indicate that Compound II does not react with O_2^-. (NL)

16061 HYDROGEN ADDUCT RADICAL FORMATION IN γ-IRRADIATED α-, β-, AND γ-CYCLOAMYLOSE-BENZENE. Bardsley, J.; Baugh, P. J.; Goodall, J. I.; Phillips, G. O. (Univ. of Salford, Eng.). J. Chem. Soc., Chem. Commun.; No. 21, 890-891(6 Nov 1974).

α-, β-, and γ-Cycloamyloses are suitable "host" matrices for stabilizing hydrogen adduct radicals formed by hydrogen atom addition to the benzene "guest" during γ-irradiation and compare favorably with the extensively used adamantane matrix for the observation of extremely well resolved ESR spectra. (auth)

16062 SOLUTE ION AND RADICAL FORMATION IN THE PULSE RADIOLYSIS OF ACETONITRILE SOLUTIONS. Baptista, J. L.; Burrows, H. D. (Univ. of Coimbra, Portugal). J. Chem. Soc., Faraday Trans., I; 70: 2066-2079(1974).

Following microsecond pulse radiolysis of solutions of a variety of solutes in acetonitrile, absorptions assigned to solute cation radicals, anion radicals, excited states and neutral radicals are observed. Pulse radiolysis of solutions of tri-p-tolylamine or triphenylamine yields the amine radical cations, whose absorptions are observed to grow-in by a second-order process after the electron pulse. Rate constants are reported for this process, which is suggested to be electron transfer to acetonitrile radical cation or cation dimer. Yields of G ~ 0.2 are reported for the oxidizing species. Oxidation via a different route involving hydrogen atom transfer is suggested to occur following pulse radiolysis of solutions of phenol or phenothiazine. Pulse radiolysis of solutions of benzophenone or biphenyl yields the solute radical anions in agreement with previous studies on this system. The mechanism of acetonitrile radiolysis is discussed with a consideration of this and previous studies. (auth)

16063 APPLICATION OF MATHEMATICAL SIMULATION METHOD TO THE PROCESS OF RADIATION GRAFTING OF ACRYLONITRILE TO VISCOSE. Staroverova, L. L.; Granovskij, Yu. V.; Kabanov, V. Ya.; Spitsyn, I. (AN SSSR, Moscow. Inst. Fizicheskoj Khimii). Dokl. Akad. Nauk SSSR; 215: No. 5, 1168-1171(11 Apr 1974). (In Russian).

The radiation grafting of small quantities of the monomer to viscose causes substantial changes in its physio-mechanical properties. An interpolation model was constructed for the process of radiation modification of viscose for selection of optimum grafting conditions. The grafting was made at high dose rates. The grafting was done directly by irradiation of viscose filaments with ^{60}Co sources at a dose rate of 4.8×10^3 rad/sec in the temperature interval from 20 to 50°C. The grafting of acrylonitrile improved the durability of viscose. As a result of experimental planning, it was possible to construct an interpolation model of the process adequately describing the process. The optimum conditions for the grafting of 5 to 10 acrylonitrile to viscose filaments were determined. (tr-INIS)

16064 PHOTOCHEMICAL DECOMPOSITION OF SODIUM CHLORATE. Herley, P.J. (Materials Science Department, State University of New York at Stony Brook, New York 11794); Levy, P.W. J. Chem. Phys. 62: No. 1, 177-182 (1 Jan 1975).

The photolysis of powdered $NaClO_3$ exposed to 254 nm light has been investigated using unirradiated crystals and material subjected to ^{60}Co gamma−ray irradiation. Pressure versus time curves for all samples increase monotonically and eventually exhibit a constant rate of oxygen gas evolution. The curves appear to contain one saturating exponential component and one linear component. This final stage approximates a second order dependence on light intensity. This dependence can be attributed to the photolytic generation of additional decomposition sites. Gamma−ray irradiation increases the variation from the observed almost second order dependence, decreases the magnitude of the exponential component, and decreases the time required to reach the final stage and the steady state rate. Irradiation also produces color centers and a shift in the apparent optical absorption edge. These observations are consistent with a previously developed phenomenological theory. (auth)

16065 PRIMARY RADIATION DAMAGE IN THYMIDINE. Box, H.C.; Budzinski, E.E. (Department of Biophysics, Roswell Park Memorial Institute, Buffalo, New York 14203). J. Chem. Phys. 62: No. 1, 197-199 (1 Jan 1975).

Several primary radiation products produced by ionizing radiation in the nucleoside thymidine have been stabilized at 4.2°K; two have been identified by ESR−ENDOR spectroscopy. One of these products is formed by reduction of the thymine ring. The other product results from the loss of a hydrogen atom from the 5'−hydroxy group. (auth)

16066 RARE GAS SENSITIZED RADIOLYSIS OF ETHYL MERCAPTAN IN THE GAS PHASE. Migdal, E.; Sobkowski, J. (Univ., Warsaw). Radiat. Eff.; 23: No. 3, 151-157(1974).

The gamma radiolysis of ethyl mercaptan in a mixture of neon, argon, and krypton has been studied. Possible mechanisms of products formation have been considered. The distribution of ions formed upon the transfer of reactivity from rare gases to ethyl mercaptan has been estimated. (auth)

16067 ELECTRON SPIN RESONANCE STUDY OF RADICALS IN γ-IRRADIATED MONO- AND POLY-CYCLIC OLEFINS: SUBSTITUTED CYCLOPENTADIENES. Faucitano, A.; Martinotti, F. F.; Cesca, S. (Univ., Pavia, Italy). J. Chem. Soc., Perkin Trans., II; No. 14, 1694-1698(1974).

The matrix isolation technique coupled with ESR spectroscopy has been used to obtain information regarding the nature and the reactions of free radical intermediates from the radiolysis of some substituted cyclopentadienes. The mechanisms of radiolysis are mainly concerned with changes in the cyclopentadienyl part of the molecules and predominantly involve the breakage of the weakest bisallylic C−H bonds and [1,4] opening of the conjugated system. An ionic mechanism has been attributed to the latter process by comparisons with uv irradiation experiments. Interesting ESR properties of new cyclopentadienyl-type radicals have also been observed. (auth)

16068 GAMMA-RADIOLYSIS OF POLYALCOHOLS IN OXYGENATED AQUEOUS SOLUTION. Stockhausen, K. (Bundesgesundheitsamt, Berlin (F.R. Germany). Abt. fuer Strahlenhygiene). Atomkernenergie; 24: No. 1, 51-54(1974).

3 tabs.; 16 refs.

Gamma radiolysis of aqueous solutions of polyalcohols, ethylene glycol, glycerol, m-erythritol, d-arabitol, d-mannitol, in the presence of oxygen leads to the formation of carbonyl compounds (hydroxyaldehydes and hydroxyketones) and hydrogen peroxide as the only products. The yields in oxygen saturated solution are G(carbonyl) = 3.4 and $G(H_2O_2)$ = 3.7, respectively. Taking an 80 : 20 percent gas mixture of $N_2O + O_2$ instead of pure oxygen G(carbonyl) = 6.1 and $G(H_2O_2)$ = 3.7 are obtained. The pH in the range of pH = 3.0 to pH = 12.0 has no or little effect on the composition and yields of the products of irradiation. The addition of ferrous ions results in a remarkably higher yield of organic products: G(carbonyl) = 33. A mechanism confirming the formation of hydroxycarbonyl compounds and excess of hydrogen peroxide is suggested. (auth)

16069 GAMMA RADIOLYSIS OF ETHYL MERCAPTAN SENSITIZED BY ARGON IN THE PRESENCE OF ELECTRON, PROTON, AND RADICAL SCAVENGERS. Migdal, E.; Sobkowski, J. (Univ., Warsaw). Radiat. Eff.; 23: No. 3, 159-163(1974).

The effect of electron, proton, and radical scavengers on the radiolysis of ethyl mercaptan sensitized by argon has been studied. The mechanism suggested previously involving the neutralization of major positive ion has been confirmed. Ethyl mercaptan was found to be a very strong proton acceptor. The use of radical scavengers provided valuable information on reactions of sulphohydryl and thiyl radicals. (auth)

16070 EFFECT OF LIGHT ON GAMMA-INDUCED RADICALS IN SINGLE CRYSTAL. Shul'ga, S. Z.; Dem'yanchuk, A. P. Zh. Prikl. Spektrosk.; 21: No. 5, 944-946(Nov 1974). (In Russian).

In gamma-irradiated single crystals of glycine after a low-temperature photolysis a reversible change in the EPR spectrum of the $NH_3^+CHCOO^-$ radical takes place on annealing. An analysis of the superfine structure parameters of the EPR spectra of the photo-excited radical confirmed the hypothesis of a photo-stimulated transfer of an alpha-hydrogen to a neighboring alpha-position with a change in superfine interaction constants. 3 refs. (tr-SJR)

16071 REACTION OF HYDROXYL RADICALS WITH OLIGOPEPTIDES IN AQUEOUS SOLUTIONS. A Pulse Radiolysis Study. Rao, P. S.; Hayon, E. (Pioneering Research Lab., Natick, MA). J. Phys. Chem.; 79: No. 2, 109-115(16 Jan 1975).

The reaction rate constants of OH radicals and the spectral characteristics of the free-radical intermediates produced from various oligopeptides in water have been studied in detail using the technique of pulse radiolysis. These include the amides of glycine, glycylglycine, tetraglycine, N-acetylglycylglycine, and glycyl-β-alanine, as well as glycylsarcosine and the N-acetyl derivatives of triglycine, trialanine, and trisarcosine. The k_{OH} values are dependent, in particular, on the state of protonation of the terminal amino group: the rate constants increase on deprotonation of the $-NH_3^+$ group. The site(s) of attack by OH radicals are also dependent upon the state of protonation of the terminal amino group: on deprotonation of the $-NH_3^+$ group, radicals in an α position to the $-NH_2$ group are preferentially formed. The transient absorption spectra of the free-radical intermediates are strongly dependent on the pK_a of the parent molecules, as well as on the pK_a of the free radicals produced. Based on these results, it is concluded that ionization of the peptide hydrogen occurs for various peptide radicals $-CONH\dot{C}(R)- \rightleftharpoons -CON^--\dot{C}(R)- + H^+$. (auth)

16072 STUDY OF THE GROUND STATE POTENTIAL CURVE AND DIPOLE MOMENT OF OH BY THE METHOD OF OPTIMIZED VALENCE CONFIGURATIONS. Stevens, W. J. (Argonne National Lab., IL); Das, G.; Wahl, A. C.; Krauss, M.; Neumann, D. J. Chem. Phys.; 61: No. 9, 3686-3699(1 Nov 1974).

Accurate theoretical potential and dipole moment curves are presented for the $X^2\Pi_i$ state of the hydroxyl radical. The theoretically determined dissociation energy is 4.53 eV as compared to the experimental value of 4.63 eV. The computed dipole moment at the experimental equilibrium internuclear separation is 1.674 D, which is in excellent agreement with the most reliable experimental value of 1.66 ± 0.01 D. A detailed, general prescription for constructing optimized valence configuration wavefunctions for diatomic hydrides is presented with OH as a specific example. (auth)

16073 REACTION OF NITROUS OXIDE WITH SOLVATED ELECTRONS IN MIXTURES OF WATER AND DIMETHYL SULPHOXIDE. Koulkes-Pujo, A. (CNRS, Gif-sur-Yvette, France); Gilles, L.; Sutton, J. J. Chem. Soc., Chem. Commun.; No. 21, 912-913(6 Nov 1974).

The rate constant of the reaction between electrons and N_2O in mixtures of H_2O-Me_2SO increases rapdily at concentrations of Me_2SO above 0.66 mole fraction suggesting that the degree of solvation of the electron diminishes markedly in these solutions. (auth)

16074 KINETICS AND MECHANISM OF DIPHENYLDIAZOMETHANE RADIOLYSIS IN BENZENE SOLUTION. Oncescu, T.; Contineanu, M. (Univ., Bucharest). Rev. Roum. Chim.; 19: No. 6, 931-939(Jun 1974).

The kinetics of diphenyldiazomethane radiolysis in benzene solution shows that the reaction order varies with the concentration of the solution. It was thus established that the mechanism involving energy transfer from excited benzene molecules to diphenyldiazomethane molecules is predominant in dilute solutions while a direct interaction of radiations with the substance occurs in concentrated solutions. (auth)

16075 RADIOLYSIS OF THE COMPLEX OXALATES IN AQUEOUS SOLUTIONS. III. Influence of Some OH Scavengers on the Radiolysis of Potassium Trisoxalatocobaltate in Neutral Aqueous Solution. Paun, J.; Memetea, T. (Univ., Bucharest). Rev. Roum. Chim.; 19: No. 6, 941-946(Jun 1974).

The influence of some OH free radical scavengers such as Br^- and SCN^- ions and aliphatic alcohols on the radiochemical decomposition yield $G(-[Co(C_2O_4)_3]^{3-})$ in neutral aqueous solution was studied. The presence of t-butyl alcohol in a concentration up to 0.1 M does not change the $G(-[Co(C_2O_4)_3]^{3-})$ value, suggesting that OH free radical does not take part in the radiolytic process of $[Co(C_2O_4)_3]^{3-}$ ion. The Br^- and SCN^- ions added to the solution strongly decrease the $G(-[Co(C_2O_4)_3]^{3-})$ yield due to the oxidation of cobaltous complex ion formed from the radiolysis of cobaltic complex, by the Br and SCN radicals: $H^- + OH \rightarrow X + OH^-(X^- = Br^-, SCN^-)$; $[Co(C_2O_4)_2]^{2-} + X \xrightarrow{C_2O_4^{2-}} [Co(C_2O_4)_3]^{3-} + X^-$. (auth)

16076 EFFECT OF RADIATION ON THE STRUCTURE AND PHYSICAL-MECHANICAL PROPERTIES OF FILLED POLYETHYLENE. Gordienko, V. P.; Grigor'ev, V. I.; Kabakchi, A. M.; Tynnyi, A. N. (Physical-Mechanical Inst., Lvov). Fiz.-Khim. Mekh. Mater.; 10: No. 6, 66-72(1974). (In Russian)

The effects of ionizing radiation (electrons at a dose rate of 1 Mrad/sec and integral dose from 5 to 100 Mrad) on the structure and physical-chemical properties of polyethylene filled with SiO_2 or TiO_2 were studied. Use of an optimum combination of absorbed dose and filler concentration is a way to the fabrication of polymer materials with a selected structure and specified complexes of physical-chemical properties. (tr-auth)

16077 SOME ASPECTS OF RADIOLYTIC OXIDATION OF PHENOL IN AQUEOUS SOLUTION. Fiti, M. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Chim.; 19: No. 6, 1083-1091 (Jun 1974).

In the megarad range radiolysis of aqueous solution of phenol in appropriate conditions, a final solid product P_A is formed corresponding to the G (-phenol) = 1 to 2 mol/100 eV. In acid solution (pH < 3) P_A is formed during irradiation and can be separated as an amorphous white yellow powder. This material is readily soluble in ethanol, acetone and water at an alkaline pH and is insoluble in water and in other nonpolar solvents at an acid pH. The dry product P_A is unstable, it gradually turns into a dark material. In neutral solution (pH = 6 to 8) P_A is formed as a colloid solution from which P_A can be separated by acidifying the solution, after irradiation. The alkaline solution (pH > 8) develops a brown-red color by irradiation and does not give any solid P_A-like products. The present results showed that P_A is probably a "so-called" polymer formed by intermolecular association between phenol and its radiolytic oxidation products. (auth)

16078 INVESTIGATION OF GAMMA-RAY INDUCED POLYMER FORMATION IN THE CARBORANES. IV. ESR of Carborane Radicals at 77°K. Thibault, R. M.; Klingen, T. J. (Univ. of Mississippi, University). J. Inorg. Nucl. Chem.; 36: No. 12, 3667-3672(Dec 1974).

The ESR spectra found for γ-irradiated pure carboranes and carboranes in organic glass-forming solvents at 77°K are reported and interpreted. In combination with optical absorption measurements in MTHF (2-methyltetrahydrofuran), these ESR spectra suggest the formation of cage-centered o-carborane anions which can be photolyzed by exciting in a strong absorption band $\lambda_{max} \approx 320$ nm. Such anions however are not the precursors of protonated 1-alkenyl-o-carboranes. The latter appear to undergo radical bridging reactions which may be partially responsible for the low rates of polymerization of 1-vinyl and 1-isopropenyl-o-carborane. Evidence for a radical formed by hydrogen loss from the o-carborane cage is also discussed. (auth)

16079 RADIATION CHARGING: A NOVEL WAY TO CHARGE FINE PARTICLES ELECTRICALLY. Heinsohn, R. J.; Levine,

S. H.; Fjeld, R. J.; Malamud, G. W. (Pennsylvania State Univ., University Park). J. Air Pollut. Contr. Ass.; 25: No. 2, 179-184(Feb 1975).

A scheme to electrically charge fine particles using electric and magnetic fields in conjunction with ionizing radiation is described. Once charged, particulate matter can be removed from the air stream by directly applying a transverse electric field. In addition, since electrostatic forces can assist filtration and wet collection systems, it may be possible to design new and improved filtration and wet scrubber systems using radiation charging. The objectives of this paper are: (1) to present expressions that predict the charge acquired by particles and (2) to present the results of preliminary experiments. (auth)

16080 TEMPERATURE DEPENDENCE OF THE ABSORPTION MAXIMUM OF THE SOLVATED ELECTRON IN LIQUID 1-PROPANOL. Dixon, R. S.; Lopata, V. J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). J. Phys. Chem.; 79: No. 2, 185-186(16 Jan 1975).

The solvated electron spectra in pulse-irradiated 1-propanol were measured over a temperature interval from 150 to 298°K. The values of the energy corresponding to the absorption maximum of solvated electrons were compared with values calculated using a semicontinuum model. There is qualitative agreement but the model is not as valid for 1-propanol as it is for the lower alcohols. (JSR)

16081 SPECTROCHEMICAL STUDY OF CROSS-LINKING OF POLYMETHYLPHENYLSILOXANE BY 500-keV PROTONS. Akishin, A. I.; Pankratova, L. N.; Zheleznikova, M. V.; Goryachev, A. N.; Titova, V. I. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 5, 732-733(May 1974).

Translated from Zh. Fiz. Khim.; 48: No. 5, 1258-1259(May 1974).

Study of the cross-linking of polymethylphenylsiloxane under the influence of protons of energy 500 keV over the dosage range 1500–7500 Mrad reveals the presence of infrared absorption bands at 1010–1020 and 1180 cm^{-1}, which are attributed to cross-links. Both bands were found also in the cross-linked portion isolated by successive treatment of the proton-irradiated polysiloxane with toluene and then diethylamine. These bands can be ascribed to cross-links formed in polymethylphenylsiloxane by protons having the above energy. (auth)

16082 AN ESR ANALYSIS OF A HEAT–STABLE RADICAL IN γ–IRRADIATED SINGLE CRYSTALS OF 1–METHYLTHYMINE. Schmidt, J. (Medical Research Center, Brookhaven National Laboratory, Upton, New York 11973). J. Chem. Phys. 62: No. 2, 370-375 (15 Jan 1975).

Free radicals formed in γ–irradiated single crystals of 1–methylthymine were studied by ESR spectroscopy. In addition to the known C6–hydrogen adduct radical, a second radical is formed which is very stable for short periods at 200°C, as well as being present in the crystals at room temperature before high temperature annealing. Computer simulation was used as an aid to identifying this radical, which is 1–methyl–5–methyleneuracil–10–yl, formed by net hydrogen abstraction from the methyl group. Certain ESR spectral features suggest molecular packing disorder about an axis constructed along C6 and N3. The principal values for proton hf couplings perpendicular to both the CH bond and the unpaired electron's *p* orbital direction, along the C–H bond and along the *p* orbital direction, respectively, in gauss, are: H_1(24.5, 8.1, 15.4); H_2(H_2–C10∥H–C6)(24.8, 6.9, 15.4); H_{C6}(14.0, 5.2, 10.5); and the *g* tensor values parallel and perpendicular to the *p* orbital direction are, respectively, 2.0018 and 2.0027. (auth)

16083 STUDY OF SOLVATION OF EXCESS ELECTRONS IN ETHYLENE GLYCOL/WATER AND METHYLTETRAHYDROFURAN MATRICES BY MATRIX ENDOR. Hase, H.; Ngo, F.Q.H.; Kevan, L. (Department of Chemistry, Wayne State University, Detroit, Michigan 48202). J. Chem. Phys. 62: No. 3, 985-989 (1 Feb 1975).

Matrix proton ENDOR signals have been measured for stabilized excess electrons produced by x irradiation at 4°K in ethylene glycol/water and in 2–methyltetrahydrofuran glasses. The matrix proton ENDOR linewidths are smaller when irradiation is carried out at 77°K. The contribution to the matrix ENDOR linewidth comes principally from predominantly dipolar interactions between the unpaired electron and the surrounding matrix protons. The change in ENDOR linewidth can be interpreted as due to a slight increase in the average distance from the trapped electron to the matrix protons contributing to the matrix ENDOR line as the temperature is raised to 77°K. This is a reflection of the solvation process for the excess electron in these organic glasses. Based on a simple model, the CH bond and molecular dipoles reorient such that the negative H end of the average CH dipole moves 0.2–0.4 Å further away from the unpaired electron as solvation becomes more complete at higher temperature. These results are consistent with the change in electron solvation implied by irreversible changes upon warming of the optical absorption spectra and the EPR linewidths of excess electrons generated at 4°K in these matrices. (auth)

16084 EFFECT OF AN EXTERNAL ELECTRIC FIELD ON THE YIELD OF FREE IONS. IV. EPITHERMAL ELECTRON SCAVENGING IN NEOPENTANE. Mozumder, A.; Tachiya, M. (Department of Chemistry and the Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). J. Chem. Phys. 62: No. 3, 979-984 (1 Feb 1975).

It has been rigorously shown that, in the Onsager model, the probability of a pair of ions escaping geminate neutralization is independent of charge scavenging irrespective of the nature of the escaping ions provided only that scavenging follows thermalization. Thus the experimental evidence that a *small* concentration of SF_6 *drastically* reduces the free–ion yield in neopentane in the presence of an external field (Schmidt) is taken to demonstrate epithermal electron scavenging in neopentane. Corroborative evidence is found in substantial reduction of free–ion yield in neopentane with relatively small concentrations of CCl_4 and CS_2 in the absence of an external field (Schmidt and Allen). On the basis of a theoretical treatment presented in this paper, the cross sections of epithermal electron attachment in neopentane are found to be 4×10^{-16}, 5×10^{-17}, and 1×10^{-18} cm^2, respectively, for SF_6, CCl_4, and CS_2. These values are obtained on analyzing the relevant experiments on free–ion yields according to the present theory. Comparison with gas–phase cross sections is attempted. (auth)

16085 HYDROXYL FORMATION ACCOMPANYING DEFECT CENTER PRODUCTION IN PROTON AND DEUTERON BOMBARDED ALUMINUM OXIDE. Gruen, D.M.; Wright, R.B.; McBeth, R.L.; Sheft, I. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). J. Chem. Phys. 62: No. 3, 1192-1193 (1 Feb 1975).

The defect center produced in Al_2O_3 by energetic neutron or electron bombardment which gives rise to a 205 nm (6.03 eV) absorption band appears with two to three orders of magnitude higher intensity in proton and deuteron bombarded samples compared to either neutron, electron or heavier ion bombardments. The infrared spectra of this system is used to show that the formation of OD or OH provides an additional mechanism of defect production. (AIP) (auth)

16086 IONIC INTERMEDIATES PRODUCED BY GAMMA IRRADIATION AT 4°K: HALOGENATED NAPHTHALENE AND BENZENE DERIVATIVES IN ETHANOL. Namiki, A. (Research Reactor Institute, Kyoto University, Kumatori–cho, Sennan–gun, Osaka, Japan). J. Chem. Phys. 62: No. 3, 990-998 (1 Feb 1975).

Optical absorption and ESR measurements have been performed for the irradiated halogenated benzene and naphthalene derivatives in ethanol at 4°K. The anions of both bromo– and chloronaphthalene derivatives were observed under steady state at 4°K, while the former anion at 77°K results in dissociation and the latter anion results in protonation. Both anions of benzene and fluorobenzene were stable at 4°K, whereas not at 77°K, indicating that protonation is inhibited at 4°K. Irradiated iodobenzene and bromobenzene solutions at 4°K showed a doublet band whose energy separation was 0.8–0.9 and 0.41–0.48 eV, which are close to the energy separation between ${}^2P_{3/2}$ and ${}^2P_{1/2}$ of I and Br, respectively. The transition energies of the long wavelength bands of these compounds and of chlorobenzene is linear with the ionization potentials of respective halide ions with a slope of close to unity. Therefore these bands may be assigned to an electron transfer band from halide ion to its counterpart benzene ring. As the electron acceptor, two models were discussed, one of which is the orbital of neutral benzene, and the other is the orbital of the phenyl radical. In solid phase, dissociative electron attachment to halogenated benzene goes through a state of metastable CT complex of a halide ion and its counterpart molecule. The irradiated p–C_6H_4BrI showed also a well resolved doublet band, suggesting that C–I bond rupture is more dominant that C–Br bond rupture. The absorption spectrum of irradiated p–C_6H_4BrCl in ethanol did not resemble either the irradiated chlorobenzene or bromobenzene derivatives, suggesting that both C–Br and C–Cl are ruptured at the same time. (auth)

16087 ELECTRON SPIN RESONANCE STUDY OF γ-IRRADIATED DIETHYLPHOSPHORIC ACID AND ITS SALTS. Ezra, F. S. Rochester, NY; Univ. of Rochester (1974). 208p. University Microfilms Order No. 75-1301.

Thesis (Ph. D.).

This study was undertaken to determine the effects of ionizing radiation on diethylphosphoric acid and its salts in the solid state. The main objectives were to identify free radical species, characterize their structures in different environments and determine mechanisms for their formation by utilizing the electron spin resonance technique. As an integral part of this investigation, the single crystal structure of magnesium diethyl phosphate (MgDEP) was determined from three dimensional x-ray diffraction data. The crystal is monoclinic, space group C 2/c with a = 22.14 (2), b = 7.998 (4), c = 9.300 (3) Å, β = 96.72 (5)° and Z = 4. Intensities were measured using the $\theta - 2\theta$ scan method with a Picker automatic four circle diffractometer and Zr filtered MoK radiation. The structure was solved by Patterson and Fourier methods and refined by full matrix least squares. The final R value was 0.061 for 732 observed reflections. Magnesium ions are located on a two-fold symmetry axis and coordinated in a nearly tetrahedral arrangement to four oxygen atoms with a mean O–Mg–O angle of 109.14° and a mean Mg–O distance of 1.091 Å. The ester conformation with respect to the phosphate group is synclinal-synclinal. ESR studies of γ irradiated crystalline MgDEP at 77°K show the presence of three free radical species. One species, $C_2H_5O\dot{P}O_2^-$ is characterized by a 600–800 G hyperfine coupling to the ^{31}P nucleus and arises, with equal probability, from the cleavage of either phosphorous ester oxygen bond. Single crystal data, taken at Q band, give Breit Rabi corrected principal values of A_z = 783, A_x = 617, A_y = 626 (± 5 G) and g_u = 2.0034, g_v = 2.0039 and g_w = 2.0023 (±.0005). 70% of the spin density is in an sp^3 orbital centered on ^{31}P while the remaining 30% is distributed among the oxygen atoms. The major free radical product trapped at 77°K is CH_3CH_2. The following principal values for the α and β proton hyperfine tensors were determined from ESR data taken at Q band: $A_x^{\alpha} = 15.9$, $A_y^{\alpha} = 20.6$, $A_z^{\beta} = 25.5$ and $A_x^{\beta} = 26.0$, $A_y^{\beta} = 26.5$ and $A_z^{\beta} = 27.6 \pm 0.5$ G. Significant reorientation of the ethyl radical occurs upon cleavage of the carbon oxygen bond. The asymmetry in the α hyperfine tensor is interpreted in terms of a two-fold potential barrier to rotation of the methylene fragment. Hindrance to rotation of the methyl group, relative to the methylene, is apparent from selective line broadening within the spectrum at 77°K. The species observed after annealing the γ irradiated MgDEP sample to 160°K is $CH_3\dot{C}HOP(O)_2OC_2H_5^-$. Its structure has been determined by deuterium and ^{13}C substitution in polycrystalline samples and by a single crystal analysis. Distortion of the CH_3CHO-fragment from planarity is approximately 5°. Hyperfine principal values for the α-hydrogen, β-hydrogen and phosphorous nuclei are: $A_z^{H\alpha} = -7.3$ G, $A_x^{H\alpha} = -15.8$ G and $A_y^{H\alpha} = 27.5$ G; $A_z^{H\beta} = 25.2$ G, $A_x^{H\beta} = 22.2$ G and $A_y^{H\beta} = 22.8$ G; $A_z^{P} = 6.1$ G, $A_x^{P} = 2.8$ G and $A_y^{P} = 4.7$ G. The predominant mechanism for transfer of spin to the phosphorous is hyperconjugation. Free radical species in a series of polycrystalline diethylphosphate salts have been identified by comparison with those in MgDEP. Formation of $C_2H_5O\dot{P}O_2^-$, $CH_3\dot{C}H_2$ and $CH_3CHO\dot{P}(O)_2OC_2H_5^-$ is predominant; however, the stability of the free radicals and their structures are dependent upon the solid state environment. In the presence of electron scavengers, Ag^+, Co^{2+} and Cd^{2+}, ESR signals from the ethyl and ethyl phosphite radicals are suppressed. Therefore, the mechanism involved in their formation must be a dissociative electron attachment. Hydrogen is abstracted primarily from the α-carbon except in silver diethyl phosphate in which case both $CH_3\dot{C}HOP(O)_2OC_2H_5^-$ and $\dot{C}H_2CH_2OP(O)_2OC_2H_5^-$ free radicals are formed. (Diss. Abstr. Int., B)

16088 EPR STUDY OF FREE RADICALS IN IRRADIATED NITRO, METHYL, AND PHENYL SUBSTITUTED PYRIMIDINES. Lorenz, P. E. Carbondale, IL; Southern Illinois Univ. (1974). 133p. University Microfilms Order No. 75-128.

Thesis (Ph.D.).

X-irradiated polycrystalline samples of 5-nitro-1-methyluracil, 5-nitro-3-methyluracil, 5-nitro-1,3-dimethyluracil, 5-nitrobarbituric acid, 5-nitroorotic acid, and 5-nitro-4,6-dihydroxypyrimidine exhibit room temperature electron paramagnetic resonance (EPR) spectra characteristic of iminoxy radicals. These radicals have an unpaired electron localized in the iminoxy moiety. Hydrogen (H) and deuterium (D) atom bombardment of 5-nitro-4,6-dihydroxypyrimidine also yields an iminoxy radical. 5-nitro-6-ethyluracil is exceptional in not forming an iminoxy radical. These findings are consistent with Benson and Snipe's research which showed that irradiated crystalline 5-nitrouracil forms a room temperature stable iminoxy radical while irradiated 5-nitro-6-methyluracil does not. An EPR single crystal study of irradiated 5-nitro-1-methyl-uracil yielded the iminoxy nitrogen principal hyperfine splitting and g-values. This single crystal study also showed the presence of small doublet and quartet splittings unresolvable in the polycrystalline spectrum. Symon's mechanism of formation of the 5-nitrouracil iminoxy radical is modified to explain all the known solid state nitropyrimidine radicals, including those that do not form iminoxy radicals. The mechanism consists of reducing the nitropyrimidine by H addition to a nitro oxygen with subsequent rearrangement where OH from the nitro group is transferred to C(6) of the pyrimidine ring. This radical may decay by loss of water, depending on the particular nitropyrimidine. Sagstuen et al.'s EPR single crystal results on irradiated 5-nitro-6-methyluracil 77°K radical are consistent with this modified mechanism. A single crystal EPR analysis of x-irradiated phenobarbital (5-ethyl, 5-phenylbarbituric acid) shows that the phenyl group is removed, leaving the unpaired electron mainly on C(5) of the pyrimidine ring. This same radical is observed in both polymorphs studied, but the principal values of the two ethylene proton splittings differ between polymorphs due to different steric hindrance effects. Principal hyperfine coupling and g-values are given. This 5-position radical was previously observed by Haak (Ph. D. Thesis) in barbital (5,5-diethylbarbituric acid). In an attempt to study a 5-position radical with a phenyl group at the C(5) carbon, 5,5-diphenylbarbituric acid was synthesized and irradiated in polycrystalline form. No EPR signal of sufficient intensity for analysis was obtained. A previous EPR analysis of an irradiated single crystal of 1,3-dimethyluracil (Benson, Ph. D. Thesis) was not able to determine if the radical was formed by H addition to C(5) or C(6) of the pyrimidine ring. Therefore, 1,3-dimethyluracil deuterated at the ring C(5) position was synthesized and irradiated. This study indicates that a 6-yl radical is formed by H atom addition to C(5) of the pyrimidine ring. This is analogous to uracil, where a 6-yl radical is also probably formed. The relationship between point group symmetry and single crystal EPR spectra is discussed. Syntheses of many of the compounds used are described in detail. (Diss. Abstr. Int., B)

16089 POLYMERIZATION OF 1-ALLYL-O-CARBORANE INDUCED BY IONIZING RADIATION. Hepburn, D. R. Jr. University, MS; Univ. of Mississippi (1974). 125p. University Microfilms Order No. 75-517.

Thesis (Ph. D.).

Investigation of the gamma-ray and electron induced polymerization of 1-allyl-o-carborane has shown that the monomer reacts with hydrogen atoms to predominately produce allylic radicals and a smaller amount of propyl radicals which undergo chain transfer to produce more allylic radicals. The allylic radicals from both sources couple to form dimers which have the same type of reactive sites as the monomer; i.e., allylic hydrogens and double bonds. At high total doses the major portion of the saturated oligomer is apparently produced via the dimers. In the liquid state the yield of unsaturated dimers decreased with increasing temperature because of reaction of the dimers with radicals. The value of G(-m) increased with increasing temperature in the liquid state. In the solid state G(-m) varied in a manner consistent with changes in frequency factors of individual reactions contributing to G(-m). An increase in the yield of saturated oligomer with decreasing temperature in the solid state is consistent with pre-orientation of monomer molecules. A negative value for the activation energy for G(-m) was found in solid state I. (Diss. Abstr. Int., B)

16090 PICOSECOND PULSE RADIOLYSIS. V. Yield of Electrons in Irradiated Aqueous Solution with High Concentrations of Scavenger. Wolff, R. K.; Aldrich, J. E.; Penner, T. L.; Hunt, J. W. (Univ. of Toronto). J. Phys. Chem.; 79: No. 3, 210-219 (30 Jan 1975).

The stroboscopic pulse radiolysis, spr, system has been used to determine the yield of electrons in aqueous solution 30 psec after irradiation in the presence of high concentrations of scavenger. Using Cd^{2+} and cystamine as efficient electron scavengers a yield, G (product), of at least 4.8 molecules/100 eV is found for electrons compared to a $g(e_{aq}^-)_{30\,psec}$ of 4.0. The yield of e_{aq}^- has also been investigated in high concentration of base. There is found to be very little, if any, increase in initial yield at concentrations up to 1 M NaOH. Small increases (~13%) are noted in initial yield at concentrations up to 5 M which are attributed to recombination of species in the radiation "spurs" or to hole reactions. Very little increase in yield was noted when high concentrations (5 M) of NaCl were used (~3%). By taking into account both the fast electron addition to scavengers observed in this paper and assuming the spur yield can be given by a simple equation, $g(e_{aq}^-)_t = 2.7 + 1.3\exp(-10^8 t)$, excellent agreement was obtained between these pulse radiolysis studies and steady-state yields. The total yield of electrons can be described by the equation, $G\,(\text{product}) = 4.8(1 - \exp(-[S]/C_{37}) + \exp(-[S]/C_{37})(2.7 + 1.3k[S])/(10^8 + k[S]))$, again in agreement with other product yield studies. (auth)

16091 SULPHANILAMIDE AS AN OH RADICAL SCAVENGER IN RADIATION CHEMISTRY. Bhattacharyya, P. K.; Saini, R. D. (Bhabha Atomic Research Centre, Bombay). Radiat. Eff.; 23: No. 1, 61-62(Sep 1974).

In connection with the radiolysis of aqueous nitric acid it has been reported by Bhattacharyya et al., (Int. J. Radiat. Phys. Chem.; 5 : 91(1973)) that the reaction of OH radical with sulfanilamide (SA) is faster than that with isopropyl alcohol. In the present communication a method is described based on the competing reactions of $Fe(CN)_6^{4-}$ and SA for OH radical to determine the rate constant for the reaction of SA with OH radical. (auth)

Radiochemistry and Nuclear Chemistry

Refer also to abstract 19070.

16092 (CONF-7306108-) TRENDS IN THE USE OF NUCLEAR RADIATION IN SCIENCE. Proceedings of a Meeting, Delft, 15 June 1973. (Interuniversitair Reactor Instituut, Delft (Netherlands)). Sept 1973. 48p. Interuniversitair Reactor Instituut, Delft, Netherlands.

Lectures delivered at the occasion of the tenth anniversary of the opening of the Interuniversity Reactor Institute are presented. The three lectures are abstracted separately. (LK)

For abstracts of individual lectures see: 15901, 15902, and 16093.

16093 (CONF-7306108-, pp 6-26) USE OF NUCLEAR RADIATION IN THE INTERUNIVERSITAIR REACTOR INSTITUUT, 1963–1973. van Loef, J. J. (Interuniversitair Reactor Instituut, Delft, Netherlands). Sep 1973.

From proceedings on trends in the use of nuclear radiation in science; Delft, Netherlands (15 Jun 1973).

In trends in the use of nuclear radiation in science.

Facilities available in the institute and the work performed in the ten preceding years are described. The main topics of research in chemistry at IRI (radiation chemistry, radiochemistry, nuclear bioengineering and data analysis) are shortly reviewed. The main topics of research in physics at IRI are: molecular physics, use of Moessbauer effect as a research tool in magnetism and surface physics, reactor physics in flux distribution studies and noise measurements, irradiation of metals and simulation studies, and health physics in studies of aerosol behavior and personnel dosimetry. Data of the educational output in theoretical and practice courses and scientific output in getting degrees are briefly reviewed. (auth)

Hot-Atom Chemistry

Refer also to abstracts 16049 and 19119.

16094 (COO-1617-40) HALOGEN ATOM REACTIONS ACTIVATED BY NUCLEAR TRANSFORMATIONS. Progress Report No. 9. Rack, E. P. (Nebraska Univ., Lincoln (USA). Dept. of Chemistry). 1974. Contract AT(11-1)-1617. 27p. Dep. NTIS $4.50.

By employing radiogas chromatography, solvent extraction, the freeze-thaw method and other techniques for determining total organic and individual product yields induced by radiative neutron capture (n,γ), isomeric transition (IT), and other nuclear processes, "hot atom" reactions of chlorine, bromine and iodine are being studied extensively in various gaseous, liquid, and solid halomethanes, hydrocarbons and other organic systems. An extensive bibliography is presented of the publications of results obtained up to the present. (JSR)

16095 (COO-2190-12) RELATIVE ENERGY TRANSFER EFFICIENCIES FROM HIGHLY EXCITED CYCLOBUTANE. Nogar, N. S.; Spicer, L. D. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 1974. 15p. (CONF-740741-1). Dep. NTIS $4.00.

From 2nd Rocky Mountain regional meeting of the American Chemical Society; Albuquerque, New Mexico, USA (8 Jul 1974).

A technique developed for studying activation-deactivation properties of very highly, vibrationally excited molecules is discussed. The relative efficiency of energy transfer from highly excited cyclobutane to cyclobutane and neon bath gases was measured and is reported. (LK)

16096 (EIR–267) CHEMICAL STATE OF SULPHUR OBTAINED BY THE ^{35}Cl(n,p)^{35}S REACTION DURING IN PILE IRRADIATION. Ianovici, E.; Taube, M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Dec 1974. 23p. Dep. NTIS (US Sales Only) $4.25.

The chemical distribution of ^{35}S produced by the ^{35}Cl(n,p)^{35}S nuclear reaction was studied. The chemical forms found after solution [S^{2-}, S^0 and higher oxidation form (SO_4^{2-} + SO_3^{2-})] coincide with Maddock's most recent experiments, the preponderent fraction being S^{2-}. The length of the irradiation time has an important role on the chemical states of radiosulfur. An oxidation process concerning S^{2-} was observed as the irradiation progressed. The effect of post-irradiation heating above and below the melting point of NaCl was investigated. By high-temperature heating an evolution of volatile ^{35}S was observed. After the melting process, the preponderent form remains S^{2-} although an oxidation process occurs. The effect of irradiation temperature on the sulfur distribution was also examined. At low-temperature irradiation the predominance of S^{2-} and S^0 was observed. (auth)

16097 (JINR-P12-8216) CHEMICAL ISOLATION OF NIELSBOHRIUM AS EKATANTALUM IN THE FORM OF ANHYDROUS BROMIDE. I. A Thermochromatographic Method for Niobium and Tantalum Bromides. Belov, V. Z.; Zvarova, T. S.; Shalaevskii, M. R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The behavior of radioactive niobium, tantalum, hafnium and other recoil atoms (from nuclear reactions induced by heavy ions), which were stopped in a mixture of Br_2 and BBr_3 vapors and, together with this brominating gas-carrier, were continuously introduced into a nickel thermochromatographic column was studied. Niobium and tantalum bromides were found to produce distinct adsorption zones occupying the same position on the column. They were separated from hafnium bromide. The time required for the niobium atoms to pass the distance from the target to the adsorption point on the column was 0.1-0.2 sec. Thus this technique might be suitable for studying the properties of nielsbohrium bromide with the known 2-sec spontaneous fission isotope of element 105. (auth)

16098 FURTHER EXPERIMENTS ON THE SOLID STATE ISOTOPIC EXCHANGE MODEL FOR THE THERMAL ANNEALING OF SZILARD–CHALMERS RECOILED SPECIES. Lazzarini, E.; Lazzarini, A. L. F. (Politecnico de Milan). J. Inorg. Nucl. Chem.; 36: No. 12, 3673-3677(Dec 1974).

By investigating the thermal annealing of atoms which suffered Szilard–Chalmers recoil in double complexes like cis and trans-[Co $en_2(NO_2)_2$][Co EDTA]·nH_2O it had been found that the isochronal annealing curves of ^{60}Co recoil species at cationic and anionic sites have the same structure and that the retentions at cationic sites are linearly correlated with those at anionic sites. The slope of the straight line represents the ratio r between the annealing probabilities at the two lattice sites. It was also ascertained that r depends on the kind of atmosphere in which the annealing is carried out. Because of the relevance of this finding for the solid state isotopic exchange model for the annealing reactions of recoil species, the phenomenon was studied in another double complex, cis- [Co $en_2(NO_2)$CNS][Co EDTA]·$2H_2O$, in order to ascertain the reproducibility of r values in different experiments carried out under constant conditions and to confirm the effect of the atmosphere composition on the r values. The reproducibility at constant experimental conditions was found satisfactory, and the dependence of r value on the experimental annealing and irradiation conditions was confirmed. The results are discussed in terms of the above mentioned model for the thermal annealing reactions of atom suffering Szilard–Chalmers recoil. (auth)

Properties of Radioactive Materials

Refer also to abstracts 15982, 16518, 16860, 16944, and 16962.

16099 (AERE-R–7871) PROCESSES FOR THE PURIFICATION OF CONCENTRATED PLUTONIUM NITRATE SOLUTIONS. Scargill, D. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Nov 1974. 38p. Dep. NTIS (US Sales Only) $5.00. UK Pounds 100.

The principal process techniques which used for the purification of plutonium were reviewed and their relative merits assessed for plant-scale application to the removal of impurities, other than fission products, from concentrated plutonium nitrate solutions. A concentrated solution of plutonium nitrate in nitric acid was assumed for the final product. Provisional flowsheets for the more favoured routes are given. (auth)

16100 (BNWL-B-39) DECONTAMINATION AND DISMANTLING OF RADIOCHEMISTRY'S C-CELL, 325A BUILDING. Summary Report. Andrews, T. K. Jr. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1970. Contract AT (45-1)-1830. 24p. Dep. NTIS $4.25.

Problems and procedures used to decontaminate and dismantle a hot cell highly contaminated with ^{238}Pu are considered. The job called for a "without mask" level of contamination to facilitate installation of new equipment. (auth)

16101 (JINR-P12-8335) DIFFUSION OF THE NUCLEAR REACTION PRODUCTS IN α-THORIUM. Reets, T.; Eichler, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The release of the nuclear reaction products Ac, Ag, Bi, Ce, Cs, I, Pb, Po, Ra, Rb, Ru, Sb, Sr, and Y from metallic α-thorium was investigated in a temperature region of 960°C to 1330°C. Diffusion coefficients were found to vary with atomic volumes of the diffusing atoms. The value d log D_0/dQ (D_0 preexponential factor, Q activation energy) for f.c.c. metals appears to depend on the atomic volume of the host metal, its heat of fusion and on its melting temperature. (auth)

16102 (ORNL-tr-2849) THERMODYNAMIC AND THERMODYNAMIC-KINETIC ASPECTS OF URANIUM AS A MULTIPLE ELECTRODE. Markovic, T.; Arizmendi, C. Translated by Dolores Souto from Acta Mex. Cienc. Tecnol.; 2: No. 3, 182-190 (1968). 9p. Dep. NTIS $4.00.

Based on thermodynamic data on uranium it was established from the electrochemical affinity (A) vs. overpotential (ΔU) diagram for a given pH and activity, that uranium is thermodynamically unstable (pH 0-7) with respect to its active behavior. However, pH > 7 uranium shows active and passive behavior. The anodic potential of passivation in alkaline solution depends on pH following the relation $U_{H,F,a} = - 1,440-0,0591$ pH. It is thermodynamically possible to explain the passivity of uranium by the formation of the double layer $U/UO_3/UO_2$. The dissolution of uranium in acid solution occurs with the evolution of hydrogen. This is consistent with the uranium as a multiple mixed electrode. (auth)

16103 (ORO-4447-015) PHYSICAL-CHEMICAL STUDIES OF TRANSURANIUM ELEMENTS. Progress Report, April 1, 1974-March 31, 1975. Peterson, J. R. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1975. AT(40-1)-4447. 29p. Dep. NTIS $4.50.

Major advances in our continuing program to determine, interpret, and correlate the basic chemical and physical properties of the transuranium elements are summarized for the period April 1, 1974 to March 31, 1975. A refined low total heat capacity crucible and heating system was employed to prepare bulk samples of californium metal which were analyzed by x-ray diffraction techniques to reveal a three phase system involving two metallic valences. A solution calorimeter was converted for potential use with small samples of radioactive materials and tested in a preliminary system configuration using a standard substance and Th metal to confirm its reliability. Einsteinium tribromide has been prepared and characterized by its absorption spectrum and x-ray diffraction powder pattern. The absorption spectrum and powder pattern of hydrogen-reduced $EsBr_3$ are different from those recorded for $EsBr_3$, indicating the probable existence of $EsBr_2$. Progress was made in the development of experimental apparatus and in the electrochemical characterization of the KF-HF solvent system for use in generating and characterizing unusual oxidation states of actinides in molten salt media. A search for fluorescence in aqueous solutions of plutonium was initiated in hopes of finding a useful method to determine low concentrations of Pu in environmental samples. Finally, an investigation of the kinetics and mechanism of the reduction of neptunium(VI) by iron(II) nitrate in nitric acid solutions has been undertaken for potential application in the Purex process. (auth)

16104 POLAROGRAPHIC BEHAVIOR OF HEPTAVALENT NEPTUNIUM AND PLUTONIUM IN AQUEOUS ALKALINE SOLUTIONS. Peretrukhin, V. F.; Alekseeva, D. P. (Inst. of Chemical Physics, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 6, 1364(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 6, 1438(Jun 1974).

The polarographic behavior of neptunium and plutonium in the heptavalent state was studied in 0.1 to 14 M NaOH solution at a rotated Pt electrode. A reduction wave to Np (VI) was observed on the polarograms of solutions of 0.1 to 0.3 M NaOH and $1 \cdot 10^{-4}-1 \cdot 10^{-3}$ M Np (VII). Further reduction to Np (V) does not occur, since the Np (VI) is formed on the cathode in an electrochemically inactive form. A second reduction wave to Np (V) appears and increases in height with increase in the alkali concentration, and two waves of equal height are observed at concentrations > 3.5 M NaOH. In the case of Pu (VII) reduction waves can be observed only for solutions > 7 M NaOH; Pu (VII) in 7 to 14 M NaOH solution gives two reduction waves. The reduction waves of Pu (VII) and Np (VII) in concentrated alkali solutions are nearly reversible, while the waves of Np (VII) in dilute alkali solutions are irreversible. The limiting reduction currents are proportional to the Np (VII) and Pu (VII) concentrations in the range $5 \cdot 10^{-5}$ to $5 \cdot 10^{-3}$ M. (JGB)

16105 IONOPHORETIC STUDY OF THE ASSOCIATION OF Pm^{3+} AND Am^{3+} IONS IN CONCENTRATED SOLUTIONS OF CALCIUM PERCHLORATE AND NITRATE. Celeda, J.; Holub, J.; Smirous, F. (Inst. of Chemical Tech., Prague). Collect. Czech. Chem. Commun.; 39: No. 12, 3599-3602(Dec 1974).

Paper ionophoresis of promethium and americium ions in solutions of calcium perchlorate and/or calcium nitrate was studied, the molarity of ClO_4^- or NO_3^- being 1 to 8. The results show that the predominant form of either ion in nitrate media containing more than 1 mol of NO_3^- per liter is the cation $[Me(NO_3)_2]^+$, whose mobility is lower than that of the free hydrated ion. (auth)

16106 PURIFICATION AND RADIOCHEMICAL QUALITY CONTROL OF ^{131}I-19-IODOCHOLESTEROL. Nelson, M. F.; Vorhees, L. C. (Vanderbilt Univ., Nashville). J. Nucl. Med.; 16: No. 1, 69-70(Jan 1975).

Radiochemical quality control and purification techniques were developed for ^{131}I-19-cholesterol. The amount of ionic ^{131}I-iodide is rapidly determined using instant thin-layer chromatography. Samples of the labeled steroid that contain greater than 8% of ionic ^{131}I-iodide are purified with one of two techniques, both using a weakly basic ion-exchange resin. The first technique, a batch ion-exchange process, is suitable for removing relatively low concentrations of ionic ^{131}I-iodide; if higher concentrations of this radiochemical contaminant are present, the second or column technique is more suitable. (auth)

16107 THERMAL CONDUCTIVITY OF MOLTEN MIXTURES OF URANIUM TETRACHLORIDE WITH SODIUM AND POTASSIUM CHLORIDES. Bystrai, G. P.; Desyatnik, V. N.; Zlokazov, V. A. Sov. At. Energy (Engl. Transl.); 36: No. 6, 654-655(Jun 1974).

Translated from At. Energ. (USSR); 36: No. 6, 517-518(Jun 1974).

A study of the temperature dependence of the thermal conductivity of molten mixtures of uranium tetrachloride with sodium and potassium chlorides showed that the thermal conductivity of the melts increases with increasing temperature. (LK)

16108 REACTIONS OF LITHIUM NITRIDE WITH CERIUM, THORIUM, AND HAFNIUM: FORMATION OF Li_2CeN_2, Ce_2N_2O, Li_2ThN_2, AND Li_2HfN_2. Barker, M. G.; Alexander, I. C. (Univ. of Nottingham, Eng.). J. Chem. Soc., Dalton Trans.; No. 20, 2166-2170(1974).

The solid-state reactions of lithium nitride with Ce, Th, Hf and CeN, ThN, and HfN have been followed by differential thermal analysis, thermogravimetric analysis, and x-ray powder diffraction methods. Reaction with the metals was found to proceed by formation of the mononitride with the ternary nitride Li_2MN_2 as the final product. The compound Ce_2N_2O was obtained by the reaction of Li_2CeN_2 and Li_2O or CeN and CeO_2. The reaction of lithium nitride with hafnium gave the ternary nitride Li_2HfN_2 which is found to be isostructural with the known nitride Li_2ZrN_2. (auth)

16109 SPECTRA, LIFETIMES, AND ENERGY TRANSFER FOR URANYL SPECIES IN SOLUTION. Pant, D. D.; Tripathi, H. B. (Deb Singh Bisht Government Coll., Nainital, India). J. Lumin.; 8: No. 6, 492-501(Apr 1974).

The lifetimes for various uranyl species under varying conditions of solvents, pH, etc., were measured. A large variation in lifetimes from about 10 μs for hydrolytic $UO_2^{2+}(UO_2)_n$ species to about 900 μs for anion complexed $UO_2(NO_3)_2$ species is observed. The lifetime data are shown to be in agreement with the calculated values when care is taken to isolate the contribution to absorption due to the F series only. The samples in which more than one species is present in emission, show energy transfer from the higher energy species to the one having lower energy of excitation. As a result of this the lifetime of the donor is decreased and that of the acceptor increased. The donor decay is found to be exponential. A rise time is also observed in acceptor emission. The energy transfer mechanism is found to be of the Stern-Volmer type transfer. (NL)

16110 STOICHIOMETRIC MAGNESIUM, CALCIUM, STRONTIUM, AND BARIUM MONOURANATES. Jakes, D.; Krivy, I. (Ustar Jaderneho Vyzkumu, Rez, Czech.). J. Inorg. Nucl. Chem.; 36: No. 12, 3885(Dec 1974).

Lattice parameters for magnesium, calcium, strontium and barium monouranates have been reported, but as the stoichiometry of uranium compounds is always slightly doubtful it was considered that a confirmation of the true stoichiometric lattice parameters would be desirable. Experimental details are given and results are presented. (auth)

16111 HETEROCOAGULATION BETWEEN COLLOIDAL PARTICLES AND CHARGED SURFACES: THE BEHAVIOR OF URANIUM(V) HYDROXIDE ELECTROCHEMICALLY GENERATED AT A MERCURY ELECTRODE. Zutic, V.; Nicolas, E.; Gerard, P.; Gierst, L. (Univ. Libre, Brussels). J. Electroanal. Chem.; 44: 107-116(1973).

The behavior of the products generated by the electroreduction of U(VI) in alkaline medium has been investigated by studying the effects of various factors (composition, potential, elapsed time) on the morphology of the chronocoulometric reoxidation curves. The results indicate, among others, that the electrogenerated U(V) anion undergoes precipitation, and that the rate of oxidation of the colloidal particles is essentially controlled by the kinetics of heterocoalescence with the mercury electrode. (Bull Sci., Sec. A.)

16112 THERMODYNAMIC PROPERTIES OF NpO(g). Ackermann, R.J.; Rauh, E.G. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). J. Chem. Phys. 62: No. 1, 108-112 (1 Jan 1975).

The thermodynamic properties of NpO(g) were determined by mass—spectrometric studies of two isomolecular exchange reactions of the type $M(g) + M'O(g) = M'(g) + MO(g)$ involving the gaseous atoms and monoxides of lanthanum and yttrium. In one series of determinations, both reactions were studied simultaneously. The standard free energy of formation of NpO(g) is given by ΔG_f° (NpO,g) = $-12890 - 13.73T$ (cal mol^{-1}) over the temperature range 1660—1980 K. An uncertainty of ±1 kcal mol^{-1} is estimated. The derived thermodynamic properties of NpO(g) suggest the existence of low—lying electronic states in the gaseous molecule. The total volatility of neptunium—bearing species over the univariant system, $NpO_2(s) + Np(l) + vapor$, was measured by the mass—effusion method, and the partial pressures of NpO(g) obtained therefrom were used to confirm the accuracy of the isomolecular results and to derive the standard free energy of formation of $NpO_2(s)$: ΔG_f° (NpO_2,s) $\simeq -256000 + 40.4$ T (cal mol^{-1}). (auth)

16113 SPECTRAL-LUMINESCENT STUDY OF CRYSTALS OF URANYL COMPOUNDS. Volodko, L. V.; Komyak, A. I.; Sevchenko, A. N.; Umreiko, D. S. (V. I. Lenin Byelorussian State University, Minsk (USSR)). J. Lumin.; 8: No. 3, 198-202(Jan 1974).

The luminescence spectra of uranyl nitrate and chloride crystals were investigated at low temperature. From polarization of the fine structure, vibrational analysis was made. Splitting of lines at 4°K are in accordance with the Davydov theory. Kinetic measurements are also utilized in identifying the electronic transitions. (INIS)

16114 THIOCYANATE COMPLEXING OF SOME TRIVALENT ACTINIDES AND LANTHANIDES. Khopkar, P. K.; Mathur, J. N. (Bhabha Atomic Research Centre, Bombay). J. Inorg. Nucl. Chem.; 36: No. 12, 3819-3825(Dec 1974).

Stability constants of thiocyanate complexes of La(III), Eu(III), Tb(III), Lu(III), Pu(III), Am(III), and Cm(III) were determined in an ammonium ion medium at 30 ± 0.1°C and unit ionic strength by a solvent extraction method. The extraction data indicate the presence of only the first two thiocyanate complexes in solution in all cases. The second thiocyanate complexes of trivalent actinides are found to have a higher stability as compared to that of the second lanthanide thiocyanate complexes. Enthalpy and entropy values of Eu(III), Am(III), and Pu(III) thiocyanate complexes have been determined by the temperature variation method and indicate some inner-complex character for the trivalent actinide complexes possibly involving partial covalent bonding. The order of stabilities of the first thiocyanate complexes of the trivalent actinides Pu(III) > Am(III) ~ Cm(III) is confirmed by an extraction chromatographic study. A similar order is suggested for higher thiocyanate complexes of the trivalent actinides from their extraction behavior with a quaternary ammonium thiocyanate. Probable reasons for the observed order of stabilities for the actinide complexes are discussed. (auth)

16115 SPECIFIC HEAT RATIO OF UF_6 MEASURED WITH A BALLISTIC PISTON COMPRESSOR. Sterritt, D. E. (Univ. of Florida, Gainesville, FL); Lalos, G. T.; Schneider, R. T. Nucl. Technol.; 25: No. 1, 150-165(Jan 1975).

Experiments with a ballistic piston compressor were made to investigate certain thermodynamic properties of gaseous UF_6. Measured gas pressures, volumes, and temperatures were analyzed with a computer program employing a numerical optimization scheme to arrive at the desired properties. The thermodynamic properties deduced include the UF_6 constant volume specific heat, specific heat ratio, and the viscous coupling constant for UF_6/He mixtures at temperatures up to 1500°K. (auth)

16116 COMPOUNDS FROM THE ADDITION OF THORIUM TETRACHLORIDE TO AZOMETHYNES. Negoiu, D.; Kriza, A.; Nasta, M. (Univ., Bucharest). Rev. Roum. Chim.; 19: No. 6, 1039-1044(Jun 1974). (In Rumanian).

Six new compounds of thorium tetrachloride and the aromatic Schiff bases were obtained and studied. The elementary analysis data, as well as study of the ir and electronic spectra allows the conclusion that the compounds obtained are molecular complexes of the type $ThCl_4 \cdot 2SBH$. (tr-auth)

16117 X-RAY STUDY OF OCTAFLUORODIURANYLATES $M'_2[M''(H_2O)][(UO_2)_2F_8]$. Udovenko, A. A.; Davidovich, R. L.; Peshkov, V. V.; Buslaev, Yu. A. (Far-Eastern Science Center, Vladivostok, USSR). Zh. Neorg. Khim.; 19: No. 12, 3401-3402 (Dec 1974). (In Russian).

X-ray studies were made on complex uranyl fluorides with the composition $M'_2[M''(H_2O)_6[(UO_2)_2F_8]$, where M' = K, Rb, Cs, or NH_4 and M'' = Mn, Co, Ni, Cu, Zn, or Cd in the monoclinic system. The elementary cell parameters, the number of formula units, and the space groups of these substances were determined and showed that the compounds $M'_2[M''(H_2O)_6] \cdot [(UO_2)_2F_8]$ form an isostructural series. (tr-auth)

16118 FORMATION OF COPPER(II), ZINC, AND URANYL COMPLEXES OF POLYVINYLPYRROLIDINONEPOLYVINYLIMINODIACETIC ACIDS. Tikhonova, L. I. (Inst. of Biophysics, Moscow). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 4, 477-480(Apr 1974).

Translated from Zh. Fiz. Khim.; 48: No. 4, 828-831(Apr 1974).

The formation of copper(II), zinc, and uranyl complexes of three polyvinylpyrrolidinonepolyvinyliminodiacetic acids differing in composition and molecular weight has been investigated. The compositions of the complexes and their formation constants have been determined potentiometrically. (auth)

16119 QUANTITATIVE STUDY OF CHEMICAL EQUILIBRIA IN SOLUTIONS OF MOLTEN SALTS BY ABSORPTION SPECTROPHOTOMETRY. Application to Neptunium. Lysy, R.; Landresse, G.; Duyckaerts, G. (Univ., Liege). Anal. Chim. Acta; 72: No. 2, 307-314(Oct 1974). (In French).

The following reactions: $NpO_2^+ + 4\ HCl \rightleftharpoons Np^{4+} + 2\ H_2O + \frac{1}{2}\ Cl_2 + 3\ Cl^-$, $NpO_2^+ + \frac{1}{2}\ Cl_2 \rightleftharpoons NpO_2^{2+} + Cl^-$, and $2\ HCl + O^{2-} \rightleftharpoons H_2O + Cl^-$ have been examined quantitatively. The reactions were studied in fused LiCl—KCl sparged with gas mixtures of definite compositions. The concentrations of the different neptunium species were measured by absorption spectrophotometry. The values of respective equilibrium constants are: $K = (9.3 \pm 0.4) \times 10^{-6}\ atm^{-1/2}$; $K_1 = (2.3 \pm 0.1) \times 10^{-2}\ atm^{-1/2}$; $k = 10^{3.8}\ 1\ mol^{-1}\ atm^{-1}$. The standard potential of the system NpO_2^{2+}/NpO_2^+ was determined to be $E^0 = 0.220$ V (vs. standard chlorine electrode). (auth)

16120 KINETICS OF THE DISPROPORTIONATION OF NEPTUNIUM(V) IN PERCHLORIC ACID SOLUTION. Koltunov, V. S.; Tikhonov, M. F. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 4, 495-497(Apr 1974).

Translated from Zh. Fiz. Khim.; 48: No. 4, 860-864(Apr 1974).

The kinetics of the disproportionation of NpO_2^+ ions in $HClO_4$ + $NaClO_4$ solutions were investigated at an ionic strength I = 5 in the range 72—92°C. To prevent the reverse reaction, small amounts of hydrazine, which rapidly reduces neptunium(VI) to neptunium(V), were added to the solution. The disproportionation reaction is of second order with respect to both neptunium (V) and H^+ ions and the rate constant is $(8.1 \pm 0.3) \times 10^{-2}$ $litre^3$ $mole^{-3}$ min^{-1} at 92°C and I = 5. The activation parameters are $\Delta H^* = 17.6$ kcal $mole^{-1}$, $\Delta S^* = -24$ e.u., and $\Delta F^* = 24.7$ kcal $mole^{-1}$ (at 25°C). (auth)

16121 DIVANADATES OF THORIUM. Baran, E. J.; Gentil, L. A.; Pedregosa, J. C.; Aymonino, P. J. (Universidad Nacional, La Plata). Z. Anorg. Allg. Chem.; 410: No. 3, 301-312(Dec 1974). (In German).

It is shown that ThV_2O_7 appears in three polymorphic forms, two of them are crystalline and the third is amorphous. The structural behavior of these forms is analyzed with the aid of thermal, x-ray, and spectroscopic methods. The infrared spectra of the three modifications are discussed in detail. (auth)

16122 AFTER EFFECTS OF THE COBALT-57—IRON-57 ELECTRON-CAPTURE REACTION IN COBALT-57-DOPED TRICADMIUM BIS[HEXACYANOFERRATE(III)] DODECAHYDRATE. Fenger, J.; Frees, L. A. (Danish Atomic Energy Commission, Risoe). J. Phys., C (London); No. 21, 2309-2310(1974).

Mössbauer-emission spectra of cobalt-57-doped $Cd_3[Fe(CN)_6]_2$ $12H_2O$ have been recorded at various temperatures and resolved into two doublets, one symmetric for the parent $[Fe(CN)_6]^{3-}$ and one asymmetric attributed to a square-pyramidal $[Fe(CN)_5]^{2-}$ complex. The asymmetry vanishes with increasing temperature and thus cannot be attributed to a Goldanskii-Karyagin effect. The possibilities of paramagnetic relaxation are briefly discussed. (auth)

16123 THE EPR OF Cf^{3+} IN OCTAHEDRAL SYMMETRY AND THE NUCLEAR DIPOLE MOMENT OF ^{249}Cf. Edelstein, N. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720); Karraker, D.G. J. Chem. Phys. 62: No. 3, 938-940 (1 Feb 1975).

The EPR spectrum of the ground Γ_6 state of ^{249}Cf has been measured. The derived spin Hamiltonian parameters are $g = 6.273 \pm 0.010$ and $A = (7.52 \pm 0.20) \times 10^{-3}$ cm^{-1}. The nuclear spin $I = 9/2$ has been confirmed and a value $|\mu| = 0.28 \pm 0.06\mu_N$ for the nuclear dipole moment has been calculated from the hyperfine coupling constant. (auth)

16124 HYDROLYSIS OF URANIUM(VI) IN NITRIC MEDIUM. Mavrodin-Tarabic, M. Rev. Roum. Chim.; 19: No. 9, 1461-1470(Sep 1974). (In French).

The nature and stability of the ionic species formed by hydrolysis of U(VI) in nitric medium were studied by pH measurement methods (the method of the mathematical analysis of differential pH measurement curves, the formation function method, and the core and links method). It was concluded that the hydrolysis of U in nitric medium takes place by a series of pH-dependent reactions which lead to the formation of polynuclear complexes of the core and link type. The ionic species formed are less stable in nitric medium than in the inert perchloric acid medium. (tr-auth)

16125 SPECTRAL STUDY OF DIOXOURANIUM(VI) COMPLEXES WITH AROMATIC SCHIFF BASES. Biradar, N. S.; Goudar, T. R. (Karnatak Univ., Dharwar, India). Rev. Roum. Chim.; 19: No. 9, 1441-1445(Sep 1974).

A few complexes of dioxouranium(VI) have been prepared with aromatic Schiff bases and characterized by the elemental analysis. With the aid of infrared spectra it has been shown that O–U–O bonds of UO$_2^{2}$ ion are linear. These complexes are non-electrolytes in DMF and appear to have coordination number six. (auth)

16126 PREPARATION OF ^{131}I-LABELLED m-IODOHIPPURIC ACID, STABILITY STUDIES, AND COMPARATIVE ANIMAL STUDIES WITH m- AND o-IODOHIPPURIC ACIDS. Elias, H. (Technische Hochschule, Darmstadt, Ger.). pp 416-421 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The ^{131}I radioactive label of m-iodo-hippuric acid is less readily split off than in the more commonly used o-iodo-hippuric acid (Hippuran). The preparation of this compound is described. Tests in both rats and dogs showed no difference in the behavior of the m- and o-iodohippuric acids with regard to their in-vivo properties. (auth)

Radioactive Waste Treatment

Refer also to abstract 15993.

16127 (ARH-2731(Rev.)) REVIEW OF LITERATURE PERTINENT TO THE AQUEOUS CONVERSION OF RADIONUCLIDES TO INSOLUBLE SILICATES WITH SELECTED REFERENCES AND BIBLIOGRAPHY (REVISED). Brownell, L. E.; Kindle, C. H.; Theis, T. L. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Dec 1973. Contract AT(45-1)-2130. 117p. Dep. NTIS $5.45.

The literature available on mineral synthesis was found to be extensive, however, applications with respect to converting radionuclides to synthetic crystalline minerals appear to be limited. The concept of incorporating mixed fission products and actinides from nuclear waste solutions inside crystalline aluminosilicate mineral lattices via a bulk process appears to be novel. The Atomic Energy Commission national laboratories have studied waste immobilization in silicates. Their contributions include studies on high-temperature clay processes and ion exchange "fixation" processes. Previous workers have concentrated on "fixing" fission products on clay minerals by ion exchange processes. In such processes the fission products are leachable. Some investigators fixed the fission products more securely by heating the clay minerals to temperatures in the range of 1,000°C. However, the reaction of cesium with bentonite that produces relatively insoluble crystalline products of low leachability apparently was overlooked. Two types of aqueous cation "fixation" in clay minerals are possible in which the degree of fixation and the mechanism differ. "Fixation" of cesium in a pollucite crystal structure is a mechanism that involves a three-dimensional cage and complete transformation of the aluminosilicate lattice during the synthesis. Cesium fixed in a three-dimensional aluminosilicate lattice is immobilized to a greater degree than cesium in a "relatively fixed" condition between one-dimensionally collapsed lamellae of a clay mineral. Aqueous synthesis of cation aluminosilicates is termed "hydrothermal" at elevated pressures. At atmospheric pressure the synthesis is called the "Gel Process" or the "Clay Reaction Process" if a reactant is a clay mineral. The Clay Reaction Process is a means of converting soluble radioactive cations to insoluble microcrystalline aluminosilicates. The type of aluminosilicate depends on the composition of the liquid waste and the reactants used. Another application of the Clay Reaction Process is the conversion of relatively pure radioactive cesium salts to the mineral pollucite. Pollucite can be easily formed by reacting bentonite, pyrophyllite or kaolinite plus silica gel with alkaline solutions of cesium salts (CsCl, CsOH, CsNO$_3$, etc.). With these materials, the reaction goes through a phase where the clay is converted to an amorphous material (gel) and much of the aluminum and silicon in the clay are dissolved. At temperatures of 80 to 100°C the reaction of these materials produces spherical crystallites of pollucite as a product. The type of product obtained from these reactions is partly controlled by the type of anions in the alkaline solution. The anions, in some circumstances, are considered to behave as structural templates in zeolite crystallizations, causing specific aluminosilicate structures to form. For example, halides, phosphate, perchlorate and some other anions cause sodalite to form. The reaction of the clays with alkaline waste occurs at a relatively low temperature (70 to 100°C). At 100°C the reaction is reasonably fast, reaching completion after less than one day. The product is a hard mass of small insoluble cancrinite crystals. All clay minerals do not behave the same in the Clay Reaction Process. There is an influence of composition and structure of the mineral as yet only partially understood. Other cations do not behave as cesium but all in Groups II through VIII of the periodic table form insoluble silicates or aluminosilicates, giving promise to immobilization of all radionuclide cations that are present in chemical processing waste solutions. (auth)

16128 (BLG-492) DYNAMICAL ADSORPTION OF IODINE ON MOLECULAR SIEVES. Collard, G.; Broothaerts, J.; Goossens, W.; Stevens, J. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Jun 1974. 23p. Dep. NTIS (US Sales Only) $4.25.

The adsorption of iodine on Linde Union Carbide 13X molecular sieves was investigated at 30°C for iodine concentrations in dry nitrogen between 6 and 40 vpm. In this range of concentrations the capacity of these sieves remains constant at about 0.63g I$_2$/g M.S. The dynamical behavior of this adsorption on a 5-cm-diam bed is derived from break-through curves determined from continuous γ-counting of the traced iodine outlet concentration. The break-through lower than 50% can be evaluated by applying surface-reaction-kinetics-control on the constant pattern model. (auth)

16129 (BNWL-1871) QUARTERLY PROGRESS REPORT RESEARCH AND DEVELOPMENT ACTIVITIES WASTE FIXATION PROGRAM JULY THROUGH SEPTEMBER 1974. McElroy, J. L. (Comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-1830. 70p. Dep. NTIS $5.45.

Three melting concepts are currently being evaluated for use in converting waste calcine to glass. These are a resistance-heated metallic melter, a joule-heated (electric) ceramic melter, and in-can melting. Installation of the fluidized bed pilot plant has been completed, and the system is currently undergoing preliminary testing for startup. The unit will employ in-bed combustion and stainless steel off-gas filters. A new waste composition, PW-7, has been added to the Waste Fixation Program. The waste is "clean," containing only 0.01 M Na and 0.1 M Fe; however, it does contain inert gadolinium, a soluble poison added to the reprocessing plant dissolver. Stored energy measurements have been completed on a series of neutron-irradiated specimens and one ^{244}Cm-doped specimen. A typical value of heat released for borosilicate glass is about 20 cal/g. Initial release starts at temperatures below 150°C. With borosilicate glass the rate increases as the temperature rises; it passes through a maximum and then drops to zero below 600°C. In radiolytic gas generation studies, a critical assessment is being made of the calcine material waste surface to determine the effects of gas adsorption, since this surface is expected to readsorb some of the radiolytically produced gasses. Sintering tests have been made with several types of calcine and glass frit mixtures, and their behavior during sintering has been monitored. Sintered pellets are formed at about 675°C and pressures as low as 12 psi. The sintered pellets appear to have good physical properties. They are quite dense, generally about 3.06 g/cc where glass of about the same composition is about 3.24 g/cc. Leach test comparisons indicate about a factor of two higher leach rate for the pellets compared to 72-68 glass. Carbon and SiC coated waste particle studies continued by incorporating samples of coated particles in an aluminum matrix. Although some corrosion of stainless steel canisters may occur due to the aluminum, the encapsulation technique used for these tests looks attractive for a large scale process. (LK)

16130 (BNWL-B-74) PHYSICAL PROPERTY MEASUREMENTS ON CESIUM CHLORIDE AND CESIUM CHLORIDE–ALKALI METAL CHLORIDE SYSTEMS. Fullam, H. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Mar 1971. Contract AT(45-1)-1830. 49p. Dep. NTIS $5.50.

The cesium chloride produced in the Atlantic Richfield Hanford Company (ARHCO) waste packaging plant may contain substantial amounts of sodium chloride and potassium chloride. This contamination can affect the physical properties of the CsCl. In this study several properties of CsCl were measured and the effect of NaCl and KCl additions on each determined. The phase diagrams for the systems CsCl–KCl, CsCl–NaCl, and CsCl–KCl–NaCl were determined. The melting point of pure CsCl was determined to be 645°C. The CsCl–KCl system shows a minimum melting point of 605°C at a KCl content of 19.2 wt %. The CsCl–NaCl system shows a eutectic of 493°C at 15.5 wt % NaCl. In the ternary system a minimum melting point of 478°C was found at a composition of 68 wt % CsCl–17 wt % KCl–15 wt % NaCl. Pure cesium chloride undergoes a phase transition, on heating, which begins at 475°C. When KCl is added the temperature at which the phase transition begins drops sharply. For a CsCl system containing greater than 20 wt % KCl the phase transition initiates below 315°C. The addition of NaCl to CsCl causes only a slight drop in the phase transition temperature. In the ternary system, CsCl–KCl–NaCl the phase transition temperature decreases sharply as the CsCl content is decreased. Additions of NaCl and/or KCl to CsCl causes the thermal expansion coefficient (below the phase transition) of the system to decrease. The linear expansion due to the phase transition is almost directly proportional to the CsCl in the system. The presence of impurities can have a pronounced effect on the properties of CsCl; and these effects must be considered when designing the container which is to be used for packaging the CsCl. (auth)

16131 (CONF-741026-7) STUDY OF THE PROCESS, TECHNOLOGY, AND THE NORMAL BEHAVIOR OF THE MARCOULE ALPHA INCINERATOR. Auchapt, J. N. (CEA Centre de Marcoule, 30 - Bagnols-sur-Ceze (France)). 1974. Translated from Conference on the Control of Plutonium-Contaminated Solid Wastes, Marcoule, October 14–16, 1974. 15p. Dep. NTIS $4.00.

From seminar on the management of plutonium-contaminated solid wastes; Marcoule, France (14 Oct 1974).

The Marcoule incinerator is designed to burn rubber, PVC, and cellulose wastes containing plutonium. After two years of burning radioactive materials at full scale (1 kg/hr unit for pilot plant), conclusions are drawn about the process and technology that will be useful in designing the next larger incinerator (10 kg/hr unit). (LK)

16132 (HEDL-TME-74-61) COMMERCIAL ALPHA WASTE PROGRAM. Quarterly Progress Report, July–September 1974. Cooley, C. R. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-2170. 35p. Dep. NTIS $4.00.

This is the second Quarterly Progress Report on the Commercial Alpha Waste Program being conducted at the Hanford Engineering Development Laboratory (HEDL) for the Division of Waste Management and Transportation, USAEC. Progress to date on identification and classification of fuel fabrication and fuel reprocessing wastes is discussed, as well as work on development of the acid digestion process and development work on product storage and disposal of wastes. Data on HEPA filter usage throughout the United States are also discussed. (auth)

16133 THE ABSORPTION OF DIBUTYL PHOSPHATE AND ZIRCONIUM FROM PUREX PROCESS SOLVENT BY MACRORETICULAR ION EXCHANGE RESIN. Anders, R. T. (Imperial Coll. of Science and Technology, London (UK). Dept. of Chemical Engineering and Chemical Technology). [nd]. 112p. INIS.

33 refs.; copies available from Atomic Energy Board, Pelindaba, Pretoria (South Africa).

The absorption of dibutyl phosphate and zirconium from a solution of 20% tributyl phosphate in an odorless kerosene by a strong base macroreticular ion exchange resin was investigated. This study has relevance to the nuclear fuel reprocessing industry, where an efficient absorption process for the clean-up of organic solvent is desirable. The absorption of dibutyl phosphate is a stoichiometric chemisorptive process. Absorption kinetics appeared to conform to the expression $(dC/dt) = kC^{\eta}$ where $\eta = 2.3$ and k is a function of initial concentration. The rate of absorption was the same for aqueous and organic solvent, and the kinetics were not influenced by the presence or absence of water in the solvent. The behavior of irradiated tributyl phosphate–odorless kerosene was also investigated with respect to dibutyl phosphate absorption. Zirconium was extracted from an aqueous concentrated nitric acid solution into the organic phase, which was then contacted with the resin. Over a wide range of concentrations zirconium adsorbed to the resin with first order kinetics and an equilibrium distribution coefficient of around a thousand, until a capacity of about 10% of the stoichiometric equivalent of the resin was reached. The introduction of dibutyl phosphate to the solvent, or the irradiation thereof, reduced the absorption rate and equilibrium distribution coefficient of zirconium on the resin. Zirconium sorption was a physical adsorption or weak chemisorptive process. The absorption of β-activity from some used Windscale Purex process solvent was also measured. (INIS)

16134 DEVELOPMENT OF AN OPTIMAL CLARIFIER FOR THE APPLICATION OF SELECTIVE SORBENTS USED IN RADIOACTIVE WATER DECONTAMINATION. Napravnik, J.; Verner, M. (Inst. of Nuclear Research, Rez, Czech.). Jad. Energ.; 20: No. 11, 367-371(Nov 1974). (In Czech).

A method of liquid radioactive waste treatment by means of sorption of biologically dangerous nuclides on selective sorbents is described. The most convenient type of floculator is proposed for purification of contaminated waters from nuclear power plants. (auth)

Radioisotope Production

Refer also to abstracts 17767 and 17769.

16135 (JINR-12-7573) EXPRESS GASOTHERMOCHROMATOGRAPHIC METHODS OF RADIOACTIVE ELEMENT PRODUCTION. 6. Separation of Radioactive Thallium Isotopes from Irradiated Lead Oxides. Bayar, B.; Zaitseva, N. G.; Novgorodov, A. F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 18p. (In Russian). INIS.

A study is carried out on the gasthermochromotographic behavior of a small amount of thallium on distillation from irradiated lead oxides (Pb_3O_4, PbO_2 and PbO). Consideration is given to the possible mechanism for the behavior of volatile thallium oxides during evaporation and transport in the gaseous phase. The results show that the higher lead oxides can be used as targets for the rapid separation of the radioactive isotopes of thallium, osmium, and mercury. (24 refs.) (tr-auth)

16136 (MLM-2151) SOLVENT EXTRACTION METHOD FOR THE RECOVERY OF THORIUM-229 FROM AGED URANIUM-233. Hertz, M. R.; Stringham, W. S.; Watrous, R. M. (Mound Lab., Miamisburg, Ohio (USA)). 31 Jan 1975. Contract AT-33-1-GEN-53. 14p. Dep. NTIS $4.00.

A method for "milking" the thorium-229 from aged uranium-233, followed by purification of the product thorium-229, was developed. The method includes uranium-thorium separation by liquid-liquid solvent extraction with di-sec-butylphenylphosphonate followed by single stage liquid-liquid solvent extraction purification of the thorium with tri-n-octylphosphine oxide. The diluent for both extractants is diethylbenzene. An automatic extraction-stripping apparatus with recirculating organic extractant was assembled, incorporating modified Schmall extractors, and operated for the uranium-thorium separation step. Scale-up of this step, using countercurrent extraction and stripping columns, is believed to be feasible. (auth)

16137 EXPERIMENTAL PRODUCTION OF RADIOISOTOPES FOR MEDICAL DIAGNOSTICS. Cogneau, M.; Deutsch, J.; Gillet, R. (Univ., Louvain, Belg.). J. Belge Radiol.; 57: No. 4, 333-336(1974). (In French).

The use of radioactive isotopes for medical diagnosis requires short half-life and γ of β^+ isotopes. The isotopes prepared with a cyclotron are often convenient. The present paper describes how ^{123}I and ^{52}Fe are perfected in the reactions $^{nat.}Sb(\alpha,2n)^{123}I$, $^{127}I(p,5n)^{123}Xe \rightarrow {}^{123}I$, $^{55}Mn(p,4n)^{52}Fe$. (auth)

16138 CYCLOTRON PRODUCTION OF CARRIER-FREE ^{123}I USING THE REACTION $^{127}I(p,5n)^{123}Xe$. Fusco, M. A.; Peck, N. F.; Jungermann, J. A.; Zielinski, F. W.; DeNardo, S. J.; DeNardo, G. L. (Univ. of California, Davis). pp 367-375 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A cyclotron procedure for the production of high purity, carrier-free ^{123}I suitable for immediate radiopharmaceutical use is described. (CH)

Reactor Fuel Reprocessing

Refer also to abstracts 16523, 16528, and 19082.

16139 (ANL-8142) MELT DECLADDING OF FAST REACTOR FUEL. Winsch, I. O.; Johnson, T. R.; Pierce, R. D.; Miller, W. E. (Argonne National Lab., Ill. (USA)). Nov 1974. Contract W-31-109-eng-38. 38p. AT.

One step in processing highly radioactive fast reactor fuels is removal of the cladding from the oxide fuel. A proposed method for accomplishing this step in a remotely operated facility is to melt the stainless steel at 1450-1650°C and to separate the molten liquid metal phase from the oxide solid. Five techniques for phase separation have been studied in small-scale experiments in which the stainless steel components of 3-in.-long sections of mocked-up unirradiated fuel assemblies were melted. Experimental results indicate that the bulk of the molten stainless steel can be separated from the oxide solids. A phase-separation technique in which first molten steel and then oxide pellets are poured from a crucible into separate receiver vessels was chosen as a basis for a conceptual design of a melt-decladding head-end facility. Experimental results and results of the conceptual design study indicate that melt decladding is feasible; however, considerable equipment development work would be needed to achieve a successful decladder design of reasonably long life for a remotely operated facility. Because of the high temperature required in the decladder and the chemical reactivity of metals volatilized from the stainless steel and the fuel, problems will be encountered in selecting construction materials for the decladder. (auth)

16140 (CEA-CONF-2705) UTILIZATION OF COMPUTERS IN FUEL REPROCESSING PLANTS. Chabert, J. (CEA Centre de Marcoule, 30-Bagnols-sur-Ceze (France)). 1974. 32p. (In French). (CONF-740687-1). Dep. NTIS (US Sales Only) $4.75.

From conference on utilization of computers in fuel reprocessing plants; Arles, France (4 Jun 1974).

The possibility of using computers to control fuel reprocessing plants was examined. A work group containing members of different branches has compared the various control systems at present available on the market. On the basis of technical, economic and safety considerations, solutions were proposed and a policy was suggested in regard to the use of computers for controlling both existing and future plants. (FR)

16141 (ORNL-TM-4724) EFFECT OF ACTINIDE REMOVAL ON THE LONG-TERM HAZARD OF HIGH-LEVEL WASTE. Claiborne, H. C. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 48p. Dep. NTIS $5.50.

A possible method for improving the management of high-level radioactive waste involves the removal of actinides to a very high degree to reduce the long-term hazard potential of wastes stored in geological formations. In this method, actinides are removed to levels where their contribution to the hazard potential is comparable to that from the long-lived fission products. Removal of actinides to this extent reduces the long-term (>1000 years) hazard potential of high-level waste to about 5% of that for pitchblende mineral on the basis of the hazard index. Calculations showing removals of 99.99% plutonium, 99.9% uranium, americium, and curium, and 95% neptunium from spent uranium-plutonium fuels accomplish this result. High Temperature Gas-Cooled Reactor fuel will also require removal of 99.5% thorium and 95% protactinium, and increasing the uranium removal to 99.99%. Attaining these actinide removal percentages will require removal factors that are 10 to 100 times greater than have been achieved with existing high-radiation-level processing technology. Consideration of removal of long-lived fission products and additional actinides does not appear to be warranted until it has been demonstrated that actinides can be removed to levels approaching the present calculated values. These values of actinide removals serve as a desirable goal in process development studies of the waste fractionation program at Oak Ridge National Laboratory. (auth)

16142 SOME PRELIMINARY CONSIDERATIONS OF A MOLTEN-SALT EXTRACTION PROCESS TO REMOVE TRITIUM FROM LIQUID LITHIUM FUSION REACTOR BLANKETS. Maroni, V. A.; Wolson, R. D.; Staahl, G. E. (Argonne National Lab., IL). Nucl. Technol.; 25: No. 1, 83-91(Jan 1975).

A method is described for removing tritium from liquid lithium fusion reactor blankets by extraction with molten salt. Results of distribution coefficient measurements made with lithium-lithium halide mixtures have demonstrated that tritium is preferentially distributed in the salt phase by a factor >1.0 on a volumetric basis. Other considerations related to (a) mutual solubilities between the salt and metal, (b) phase separation, (c) blanket neutronics, (d) corrosion, (e) fabrication, and (f) recovery of tritium from the salt phase indicate that the extraction process should be feasible. Calculations based on the blanket processing requirements for the reference theta-pinch reactor (RTPR) show that the equipment and power needed to carry out a molten-salt extraction operation on the lithium blanket of the RTPR are reasonable. (auth)

16143 PLASTICS IN NUCLEAR PROCESSING PLANTS. Bruns, L. E. (Atlantic Richfield Hanford Co., Richland, WA). Chem. Eng. Progr.; 71: No. 1, 59-62(Jan 1975).

Safety has been enhanced in the Pu reclamation facility by use of plastics to help assure containment of the plutonium and minimize buildup of plutonium (a critical mass problem). Use of plastics has helped to reduce exposure to personnel and to avoid in-hood injuries from metal parts. An increased effort should be made to improve the quality assurance of the final product and by further research to establish radiation exposure limits, improved pumps, valves and plastic instruments, a nitric acid resistant primer coat, and new uses of plastics in the waste management field. (auth)

16144 METHOD FOR REMOVING RARE EARTHS FROM SPENT MOLTEN METALLIC FLUORIDE SALT MIXTURES. McNeese, L. E.; Ferris, L. M.; Smith, F. J. (to United States Atomic Energy Commission). US Patent 3,853,979. 10 Dec 1974. Filed date 14 Aug 1972. 8p.

An improved method for reprocessing spent molten metallic fluoride salt mixtures of rare earths is provided wherein the rare earths are reductively extracted from the spent molten salt which is essentially free of uranium and protactinium values into a molten bismuth solution containing lithium and/or thorium metal reductants, then back extracted from the bismuth solution into an acceptor salt solution selected from the group consisting of lithium chloride, lithium bromide, and mixtures thereof, and finally recovered from the acceptor salt solution. (Official Gazette)

CONTROLLED THERMONUCLEAR RESEARCH

Plasma Confinement and Heating

16145 (CONF-741086-9) CONTROLLABILITY OF A STEADY-STATE TOKAMAK FUSION REACTOR. Sabri, Z. A.; Husseiny, A. A. (Iowa State Univ. of Science and Technology, Ames (USA). Engineering Research Inst.). Sep 1974. 4p.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

The controllability of a steady-state fusion reactor by variations in the tritium enrichment, the injection rate, and the leakage rate of the fuel is examined. Changes in the tritium enrichment are assumed to be achieved by proper control of the fuel composition during injection but independent of other control modes. Variation in the leakage rate can be done through the control of magnetic fields. (MOW)

16146 (EUR-CEA-FC-730) ANNUAL PROGRESS REPORT OF THE GRENOBLE GROUP, JANUARY 1-DECEMBER 31, 1973. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service d'Ionique Generale). 1973. 101p. (In French). Dep. NTIS (US Sales Only) $8.25.

The activity of the "Service d'Ionique Generale" from January 1, to December 31, 1973 is summarized. Research was conducted on the following subjects: studies of hot electron plasmas; hf heating; construction of the Tokamak Petula and the Stellarator Wega. (FR)

16147 (EUR-CEA-FC-742) PLASMA BUILD UP BY A MOVING LIMITER IN THE JET. Mercier, C.; Soubbaramayer. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). May 1974. 54p. Dep. NTIS (US Sales Only) $5.75.

The MERCIER-SOUBBARAMAYER Code was used to investigate the moving limiter problem in the JET. Three types of transport coefficients (neoclassical, modified pseudoclassical, experimentally fitted expression) are considered for the particle diffusion and electron thermal conductivity. The computations show that the limiter expansion time depends strongly upon the choice of transport coefficients. The case without expanding limiter is compared to the case with moving limiter. Finally, the possibilities of a slower expansion were studied. (FR)

16148 (EUR-CEA-FC-744) PRELIMINARY COMPUTATIONS OF JET. Soubbaramayer; Mercier, C. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). May 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The numerical simulation code developed at Fontenay is used to carry out preliminary computations were fitted to the experimental results already obtained on neutral beam injection into Tokamak devices. (FR)

16149 (EUR-CEA-FC-745) DIFFUSION OF IMPURITIES IN TOKAMAKS IN THE PFIRSCH-SCHLUTER REGIME. Samain, A. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Jun 1974. 37p. Dep. NTIS (US Sales Only) $5.00.

The diffusion of impurity ions in the Pfirsch-Schluter regime was considered for the three possible diffusion regimes of hydrogen ions. It was found that in all cases, a strong thermal gradient could prevent plasma contamination. Another decontamination method, which consists of giving to hydrogen ions a slow motion along the lines of force, is discussed. (FR)

16150 (IPP-6/130) COLLISIONLESS PLASMA HEATING AT THE ION CYCLOTRON FREQUENCY IN A TOROIDAL DEVICE. Cattanei, G.; Croci, R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Oct 1974. 16p. (IPP-2/225). Dep. NTIS (US Sales Only) $4.00.

The rf power absorbed by the plasma in a toroidal device at the ion cyclotron resonance is evaluated with allowance for the effect of the rotational transform. It is found that the heating rate is a considerable factor larger than that evaluated for purely toroidal magnetic field. The possibility of using a fast magnetoacoustic wave at the ion cyclotron frequency Ω_i to heat the plasma in toroidal devices beyond the limit of ohmic heating has recently been receiving increasing attention. (auth)

16151 (KFTI-74-3) ELECTRON INJECTION AND PLASMA COFINEMENT IN MULTIGAP ELECTROMAGNETIC TRAP. Lavrent'ev, O. A.; Sidorkin, V. A.; Goncharenko, V. P.; Azovskii, Y. S. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1974. 18p. (In Russian). INIS.

An experimental study of the injection of electrons into a multislit, electromagnetic trap is presented. The plasma formed as a result of ionizing the residual gas is contained by a system of external magnetic and electric fields. The lifetime of the electrons is determined as a function of trap parameters and ion temperature. (tr-SJR)

16152 HEATING OF A PLASMA BY MHD WAVES. Bighel, L.; Collins, A. R.; Cross, R. C.; Falconer, I. S.; Watson-Munro, C. N. (Univ. of Sydney). pp 362 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The properties of large amplitude MHD waves propagating along a magnetic field were investigated previously. Measurements of the heating and compression of a hydrogen plasma by MHD waves are presented. (MOW)

16153 DIRECT CURRENTS PRODUCED BY HF HEATING OF PLASMA. Klima, R. (Inst. of Plasma Physics, Prague). pp 363 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

During high-frequency (hf) heating of plasma, direct currents were observed in toroidal experiments and interpreted theoretically in some particular cases. Estimates of steady state conditions are given for these direct currents. (MOW)

16154 MICROWAVE HEATING RATES FOR A PLASMA IN A DC MAGNETIC FIELD AS DETERMINED FROM INVERSE SYNCHROTRON EMISSION. Shohet, J. L.; Gilgenbach, R. M. (Univ. of Wisconsin, Madison). Nucl. Fusion; 14: No. 5, 709-713 (Nov 1974).

The microwave heating rate for a plasma in a dc magnetic field is found by multiplying the emission rate for a relativistic electron in a dc magnetic field by a correction factor corresponding to the number of incident photons and integrating this expression over a particle velocity distribution. The correction factor which relates the absorption rate to the emission rate is found to be proportional to $1/\omega^3$. The maximum heating rate always occurs below the electron cyclotron frequency. For electron temperatures greater than 50 keV, the heating rate decays as ln ω for frequencies well above the fundamental resonance. The maximum heating rate occurs at a lower frequency for higher-temperature plasmas. The high-frequency tail of the heating rate falls off more rapidly for a loss-cone velocity distribution than for a Maxwellian. (auth)

16155 BREAK-EVEN CONDITIONS FOR A ONE-DIMENSIONAL TWO-COMPONENT TORUS. Guest, G. (Oak Ridge National Lab., TN). Nucl. Fusion; 14: No. 5, 703-707 (Nov 1974).

In the two-component torus concepts at present under consideration, high-energy neutral beams are injected tangentially into relatively small tokamak devices. The resulting fast ions are localized near the center of the plasma discharge. The effect of radial variations of density and temperature (of both the fast ion and target plasma components) on the overall power balance and break-even condition is discussed. For the radial profiles analyzed, the minimum values of $N_e\tau_e$ and T_e required for break-even in a pure wet-wood burner decrease significantly for peaked fast-ion distributions. The implications of the reduced $N_e\tau_e$ requirements on machine size are examined for the transport scaling predicted in the trapped-ion regime. (auth)

16156 PARTICLE DRIFTS AND THE TRANSITION TO CONTAINMENT IN THE LT-3 TOKAMAK. Hutchinson, I. H.; Strachan, J. D. (Australian National Univ., Canberra). Nucl. Fusion; 14: No. 5, 649-656(Nov 1974).

The Canberra Tokamak LT-3 exhibits a delay between the application of the toroidal electric field and the main rise in gas current indicating bulk ionization of the gas. During this "prebreakdown" phase the electric field is high and the current is dominated by runaway electrons. The rotational transform is very low, however, and the condition for compensation of transverse particle drifts is not satisfied. A theoretical model is considered which includes only the curvature drift of the runaways. This provides estimates of the maximum energy an electron achieves before it is lost to the walls and a critical condition on the current when the transition to particle containment and total gas breakdown should occur. Measurements of runaway electron energies and gas currents in LT-3 are in agreement, within experimental and theoretical accuracy, with the predictions of the model. The effect of a compensating perpendicular magnetic field also confirms the model. The mechanisms governing the duration of the delay to breakdown remain obscure. In view of the short particle lifetime a means of re-introducing electrons, such as secondary emission, seems indicated. The prebreakdown phase may be avoided by pre-ionization to densities above a critical value. The particle drifts are then compensated and no delay occurs before the onset of exponential ionization increase. (auth)

16157 TRAPPING OF INTENSE RELATIVISTIC ELECTRON BEAMS IN TOROIDAL GEOMETRY. Gilad, P.; Kusse, B.R.; Lockner, T.R. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14850). Phys. Rev. Lett. 33: No. 21, 1275-1278 (18 Nov 1974).

An intense, relativistic electron beam (50 nsec, 400 kV, 20 kA) has been successfully injected and confined in a toroidlike system. Up to 50% of the total beam energy was injected into a 3.8−kG toroidal field. The beam was observed to have been trapped for at least 300 nsec which corresponded to five revolutions. Magnetic−probe and hard−x−ray data are presented to confirm trapping, and some general trends are noted from these preliminary results. (auth)

16158 IMPURITY TRANSPORT IN THE FM−1 SPHERATOR. Schmidt, J.A.; Sauthoff, N.R.; Hawryluk, R.J. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Rev. Lett. 33: No. 21, 1272-1275 (18 Nov 1974).

The confinement of $Z=2$ barium test ions in a $Z=1$ plasma was found to be strongly dependent on density and background plasma ion mass. Most of the characteristics of the parametric dependence of the barium confinement could be related to the superposition of an anomalous outward and a classical inward diffusion. (auth)

16159 NUMERICAL STUDIES OF MIRROR CONFINEMENT WITH AN END STOPPER. McHarg, B.B. Jr.; Oakes, M.E. (Department of Physics, University of Texas, Austin, Texas 78712). Phys. Fluids 17: No. 10, 1923-1924 (Oct 1974).

Numerical studies were made of solutions of the Fokker−Planck equation for a decaying homogeneous plasma in a mirror machine with an end stopper potential field. (auth)

16160 CUSP CONFINEMENT OF HIGH−BETA PLASMAS PRODUCED BY A LASER PULSE FROM A FREELY−FALLING DEUTERIUM ICE PELLET. Kitsunezaki, A.; Tanimoto, M.; Sekiguchi, T. (Department of Electrical Engineering, University of Tokyo, Bunkyo, Tokyo, Japan). Phys. Fluids 17: No. 10, 1895-1902 (Oct 1974).

Preliminary results of the experimental determination of the particle loss aperture sizes of the spindle cusp magnetic bottle for laser−produced high−beta deuterium plasmas are presented. The fully ionized dense plasma (with the maximum density $\sim 10^{16}$ cm^{-3} and ion energy ~ 200 V) is produced at the null−field center of the magnetic bottle, from a freely falling isolated deuterium ice pellet by a focused giant laser pulse. In preparation, the free expansion of laser−produced plasma has been studied experimentally, and the results indicate that plasmas produced can maintain the fully ionized condition with prescribed plasma parameters until it expands to a certain prescribed volume if the combination of the physical parameters is properly chosen by considering the electron−ion recombination as one of the important factors. The experimental results of cusp confinement for the plasma thus produced suggest that the loss aperture size of the ring cusp is much smaller than the local ion gyro−radius, in sharp contrast with other results thus far reported. Although the determination of the point cusp aperture radius is less complete, the rough estimates show that it is also smaller than the ion gyro−radius. (auth)

16161 PREFERENTIAL RADIOFREQUENCY PLUGGING OF MULTI−ION SPECIES PLASMAS IN A STATIC CUSPED CONFINEMENT SYSTEM. Hidekuma, S.; Hiroe, S.; Watari, T.; Shoji, T.; Sato, T.; Takayama, K. (Institute of Plasma Physics, Nagoya University, Nagoya, Japan). Phys. Rev. Lett. 33: No. 26, 1537-1540 (23 Dec 1974).

The rf preferential plugging of multi−ion species plasma is studied experimentally in a magnetic cusp: Desired ion species can be plugged and the others escape from the container. The conditions necessary to realize an impurity−free cusp reactor using this concept are discussed. It is shown that impurities, specifically krypton and argon, can be preferentially reduced in the reactor. (auth)

16162 SPATIAL AND ENERGY PARAMETERS OF THE RELATIVISTIC ELECTRON BEAM OF THE RIUS−5 ACCELERATOR. Altyntsev, A.T.; Koroteev, V.I. Sov. Phys.−Tech. Phys. 19: No. 6, 773-774 (Dec 1974).

The parameters of the relativistic electron beam in the Rius−5 accelerator have been studied in an effort to evaluate the use of this accelerator in plasma−heating experiments. The optimum conditions correspond to a beam energy of 450−500 J, a maximum electron energy of ~ 2 MeV, a beam particle density $n_e \sim 5 \cdot 10^{10}$ cm^{-3}, a beam divergence particle density $n_e \sim 5 \cdot 10^{10}$ cm^{-3}, a beam divergence particle density $n_e \sim 5 \cdot 10^{10}$ cm^{-3}, a beam divergence of $\sim 6-7°$, and a pulse length ~ 60 nsec. (auth)

16163 ELECTRON HEATING IN COLLISIONAL SHOCKS. McNeill, D.H. (Plasma Physics Laboratory, Columbia University, New York, New York 10027). Phys. Fluids 18: No. 1, 44-50 (Jan 1975).

Thomson scattering of ruby laser light at 90° was used to obtain electron temperature and density profiles for plasmas produced by strong collisional shock waves. Transverse ($B_\parallel \neq 0$) shocks of speed 3−25 cm/μsec in 50−100 mTorr deuterium were studied. Plasma created by reflecting a strong shock from a dielectric wall was also studied. It is found, in agreement with theoretical expectations, that the electron temperature (10−30 eV) is much lower than the ion temperature (100−500 eV) immediately after shock heating of the plasma. Temperature equilibration between ions and electrons, however, does not take place in the times of observation (2−4 μsec). It is shown that initial electron heating in the plasma is caused primarily by Ohmic dissipation of currents in the shock structure. For pure gas ionizing shocks ($B_\parallel = 0$), the measured electron temperature is in good agreement with theory. (auth)

16164 STIMULATED COMPTON BACKSCATTER FROM FREE ELECTRONS IN LASER−INDUCED FUSION PLASMAS. Albritton, J.R. (Laboratory for Laser Energetics, College of Engineering and Applied Science, University of Rochester, Rochester, New York 14627). Phys. Fluids 18: No. 1, 51-56 (Jan 1975).

Stimulated Compton backscatter of incident Nd:glass laser photons ($\hbar\omega \simeq 1$ eV) from free electrons ($n < 10^{19}/\mathrm{cm}^3$ at $\kappa T \simeq 10^3$ eV) in laser−induced fusion plasmas is investigated. The threshold for stimulated amplification of reflected radiation against spontaneous loss is 10^9 W/cm^2 incident intensity while the low gain of the system determines the threshold effectively at 10^{15} W/cm^2. For 5×10^{18} free electrons/cm^2 in the plasma, steady state reflectivities of 10^{-4} are calculated for 10^{16} W/cm^2 incident intensity. This results from the gain being driven to small values when stimulated photon scatter dominates particle collisions and thereby tends to level the resonant scattering interval of the electron momentum distribution. At lower incident intensities or on the time scales of the transients, interesting experiments might be designed to examine this phenomenon. (auth)

Plasma Diagnostics

16165 (CEA-CONF−2713) DATA PROCESSING FOR THE TFR EXPERIMENT. Gourdon, C.; Hennion, F.; Touche, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). [nd]. 6p. (CONF-740630−8). Dep. NTIS (US Sales Only) $4.00.

From 8th symposium on fusion technology; Noordwijkerhout, Netherlands (17 Jun 1974).

The collection, storage, and processing of the experimental measurements on TFR are made with a T2000 computer. The real time system developed to perform this task is described. A brief description is first given of the various data acquisition systems. (MOW)

16166 (ORO-3027-26) MICROWAVE TRANSIENT RESPONSE MEASUREMENTS OF ELASTIC MOMENTUM TRANSFER COLLISION FREQUENCY. Technical Summary Report. McPherson, D. A.; Feeney, R. K.; Hooper, J. W. (Georgia Inst. of Tech., Atlanta (USA). School of Electrical Engineering). 1 Dec 1974. Contract AT(40-1)-3027. 137p. Dep. NTIS $7.60.

An experimental facility and the associated techniques were developed for the microwave transient response measurement of the elastic momentum transfer collision frequency of electrons in gases. The apparatus and methods are applied to the determination of the electron collision frequency in argon gas as a function of electron energy in the energy range from 0.08 eV to 4 eV. This research represents the first successful measurement of the electron collision frequency in argon near the Ramsauer minimum using the microwave transient response technique. (auth)

16167 (SAND-74-7060) OPTICAL FLOW DIAGNOSTICS FOR PLASMAS. Hill, R. A.; Aeschliman, D. P.; Hackett, C. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 13p. (CONF-750111-1). Dep. NTIS $4.00.

From 13th AIAA aerospace science meeting; Pasadena, California, USA (20 Jan 1975).

Several optical diagnostic techniques, and their application to plasma flows, are discussed. These include: (1) high resolution spectroscopy for measurement of heavy particle temperature and velocity, and electron temperature and density in a supersonic, argon plasma jet; (2) laser-doppler velocimetry for measurement of mean velocity and Reynolds stress components in the supersonic free jet mixing zones downstream of two-dimensional nozzle arrays in a simulation of the gas dynamics of a chemical laser cavity; and (3) Raman spectroscopy, augmented by a light-trapping cell or a "comb filter," for measurement of temperature and density in a chemical HF laser cavity, and in a methane-air flame produced in a flat-flame burner. (auth)

16168 TEMPERATURE AND DENSITY DIAGNOSTICS OF LASER PLASMA FROM X-RAY SPECTRA OF He-LIKE AND H-LIKE MULTICHARGED IONS. Aglitskii, E. V.; Boiko, V. A.; Vinogradov, A. V.; Yukov, E. A. (Lebedev Inst. of Physics, Moscow). pp 254 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A theoretical interpretation is given for relative intensity measurements of spectral lines of ions in plasma arising in conditions of sharp focusing of laser beam (energy 20 to 30 J; pulse duration ~2 ns.; flux density ~10^{14} w/cm^2) at the surface of Mg and Al targets. (MOW)

16169 INCOHERENT SCATTERING OF LIGHT BY HOT MAGNETIZED PLASMAS. Boyd, T. J. M.; Stewart, I. N. (Univ. of Wales, Bangor). pp 365 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The incoherent scattering of light by a mildly relativistic magnetized plasma was examined. Electrons with energies ranging from ~2 to 10 keV were used. Since the appearance of modulation is sensitive to the orientation of k relative to B, light scattering may be used as a magnetic field diagnostic. Since tokamak devices have temperatures of the order of 1 kev, it is of interest to compute the spectrum of scattered radiation from a magnetized plasma including a first order relativistic correction to determine what effect this may have on the magnetic modulation. (MOW)

16170 MOST IMPORTANT DISTURBANCES IN OBTAINING ELECTRON ENERGY DISTRIBUTION FUNCTIONS FROM PLANE GUARD RING LANGMUIR PROBE CHARACTERISTICS. Saggau, B. (Univ., Stuttgart). pp 425 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The current density equation for an ideal plane guard ring probe in a low pressure plasma is discussed. Disturbances in the probe characteristics are described. (MOW)

16171 ANALYSIS OF ION VELOCITIES IN LOW-TEMPERATURE PLASMA BY MEANS OF MULTIELECTRODE ELECTROSTATIC PROBE. Sena, L. A. (Mining Inst., Leningrad). pp 426 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

In recent years a number of studies have appeared in the literature, where the ion velocities in plasma are analyzed by means of multielectrode electrostatic probes. It is demonstrated that at least under the low-temperature plasma conditions at $\eta_e \ll \eta_0$ (η_e = concentration of electrons and ions, η_0 = concentration of neutral atoms) the method is principally unsuitable for the analysis of ion velocities. (MOW)

16172 PROBE MEASUREMENTS IN A LOW TEMPERATURE HIGHLY IONIZED PLASMA. Baksht, F. G.; Dyuzhev, G. A.; Mitrofanov, N. K.; Shkolnik, S. M.; Yuriev, V. G. (Ioffe Inst. of Physics and Tech., Leningrad). pp 427 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

An experimental and theoretical investigation was made of the behavior of a probe in a highly ionized dense plasma. The ionic current branch of a probe characteristic, which is usually subjected to minimum perturbations, is considered. (MOW)

16173 ELECTRON ENERGY DISTRIBUTION FUNCTION DETERMINED BY INTERPOLATION OF AN ELECTROSTATIC PROBE CURVE. Cirant, S. (CNR, Milan). pp 428 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The calculation of the spline function, its second derivative, and the distribution function was carried out using a computer. The plasma potential is assumed to correspond to the second derivative zero point. The electron energy distribution function has permitted the measure of the electron–neutral collision frequency in different plasma conditions and has given a sophisticated description of the plasma behavior. The measurements were carried on the positive column of a cold-cathode discharge, using neon at pressures ranging from 4×10^{-2} to 10^{-1} torr. It was found that the distribution function is not Maxwellian. (MOW)

16174 INVESTIGATION OF THE MODULATED DISCHARGE PLASMA WITH THE HELP OF PULSE PROBE METHOD. Blagoev, A. B.; Kagan, Y. M.; Kolokolov, N. B.; Milenin, V. M.; Muradov, A. H. (Leningrad State Univ.). pp 429 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A probe current modulation method was used in order to measure the electron distribution function under the condition of large amplitude of the plasma potential fluctuations and in high electron density plasmas. The dependence of the longitudinal electric field intensity on the frequency and the electron distribution functions are plotted. (MOW)

16175 THEORY OF ION CURRENT COLLECTED BY CYLINDRICAL PROBE AT INTERMEDIATE PRESSURES. Tarabek, P. (Univ., Bratislava). pp 430 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The pressure range of 0.2 to 3 torr in argon is a transition interval between the limit of the collisionless sheath ($\lambda_+ \gg h$) and the limit of the collision-dominated sheath ($\lambda_+ \ll h$), where λ_+ is mean free path of the ions and h is a thickness of the sheath. For this pressure range neither collisionless nor collision-dominated theories are strictly appropriate. An approximate theory for the ion probe current is derived and the results obtained are shown to agree well with electron number density calculated from discharge current. (MOW)

16176 PROBE ANALYSIS IN AN ELECTRONEGATIVE PLASMA BASED ON A MEASUREMENT OF FLOATING POTENTIAL. Plumb, I. C.; Woolsey, G. A.; Lewis, D. B. (Univ. of New England, Armidale, Australia). pp 431 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Using the equations originally developed by Langmuir, the magnitude of the floating potential in the absence of negative ions is discussed. Probe characteristics were obtained in the Faraday dark space region of an iodine glow discharge, the iodine vapor pressure being 0.23 torr. Floating potential and probe characteristics are described. (MOW)

16177 ELECTROSTATIC SCREENING, PROBE CHARACTERISTICS, AND FLOATING POTENTIAL IN WEAKLY IONIZED PLASMA WITH NON-MAXWELL FUNCTION OF DISTRIBUTION OF ELECTRON ENERGY. Vasileva, I. A. (Inst. of High Temperatures, Moscow). pp 432 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Solutions to the Boltzmann equation are obtained allowing for the fact that the cross section of collision of electrons with heavy particles, as well as the mean energy lost by the electron during one collision within a limited interval of velocities, can be approximated by the exponential velocity function. Screening and floating potential expressions are given. (MOW)

16178 SELECTIVE DETECTION OF AN ELECTRON BEAM IN A DISCHARGE. Wisemann, K. (Univ., Marburg, Ger.). pp 434 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

To investigate the onset of collective phenomena in electron beam–plasma interactions the evolution of the distribution function of low density electron beams was measured where the number density of the beam electrons is lower than that of the plasma electrons having the same energy as the beam. This was done by a probe using a modification of the intermodulation technique which was used to obtain the second derivative $J''(U)$ of the probe characteristic $J(U)$. (MOW)

16179 INVESTIGATION INTO THE INFLUENCE OF A MAGNETIC FIELD ON THE INCREMENT OF THE PROBE FLOATING POTENTIAL DUE TO RADIO-FREQUENCY VOLTAGE. Goryaga, G. I.; Kuzovnikov, A. A.; Yaramyshev, G. S. (Moscow State Univ.). pp 435 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Experiments were carried out in a plasma of the positive column of a dc current discharge. Cylindrical molybdenum probes 0.2 mm in diameter and 5 mm long were used. The probes were placed on the axis of the discharge tube at the center of the region of homogeneity of an axial magnetic field. One of them was directed along the axis while the other was directed along the radius of the tube. The value ΔV was determined from the measured values V_f of the floating potential and V_f' of the probe potential modulated by a rf voltage at a frequency of 8.2 MHz. The results are discussed. (MOW)

16180 CHARACTERISTICS OF CYLINDERICAL LANGMUIR PROBES AT AN INTERMEDIATE PPESSURE. Inutake, M.; Kuriki, K. (Tokyo Univ.). pp 438 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Experiments were made in order to study the current-voltage characteristics of cylindrical Langmuir probes for a wide range of probe Knudsen numbers $K_i = \lambda_i/R_p$ and $K_e = \lambda_e/R_p$, Debye ratio $\rho_p = R_p/\lambda_D$ and probe aspect ratio $\gamma = L/D$. The approximate analysis of a continuum spherical probe by Su and Lam was extented to an ellipsoidal probe in order to predict the ion current characteristics of a cylindrical probe of arbitrary aspect ratio. The experimental ion currents were compared with those calculated from the ellipsoidal probe theory. (MOW)

16181 COMPARISON OF TWO INDEPENDENT PROBE METHODS FOR THE DETERMINATION OF SPACE POTENTIAL IN A STREAM OF MAGNETIZED PLASMA WITH ENERGETIC IONS. Golovanivskii, K. S.; Punithavelu, A. M. (Moscow State Univ.). pp 439 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A beam of argon plasma of 20 mm diameter with the longitudinal ion energy 1.5 keV and electron temperature 30 eV was created with the help of a PIG source and propagated along an increasing magnetic field. Results are presented for the simultaneous usage of two probe methods for determining the radial distribution of space potential in the plasma beam. (MOW)

16182 ANGULAR EFFECT OF CYLINDRICAL LANGMUIR PROBES IN FLOWING PLASMA. Maisenhaelder, F.; Mayerhofer, W. (Institut fuer Plasmadynamik, Stuttgart). pp 440 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

In order to study the mechanism of a continuously working self-magnetic plasma accelerator, cylindrical Langmuir probes were used as a diagnostic tool. The accelerator was operated with currents in the range from 2000 to 4500 A, a mass flow rate from 0.3 to 1 g/s, argon as propellant and an ambient pressure from 3×10^{-2} to 6×10^{-2} torr. With the probes radial and axial distributions of the electron temperature, the ion density and a Mach number, based on the most probable thermal velocity $v_{th} = (2\,KT_i/m_i)^{½}$ were determined. Within the experiments the ratio Rp/D varied in the range from 30 to 150; thus probes were operated in the collision-free region. (MOW)

16183 VARIABLE MAGNIFICATION SPECTROMETER. Clement, M.; Moulin, B.; Pinet, D.; Stevenin, P. (CEN, Grenoble, France). pp 443 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A new high speed spectrometer was designed for the measurement of line profiles emitted by short living plasmas (Doppler broadening, for example). This spectrometer, with a Fabry-Perot as a disperser, presents the essential advantage of possessing an electronic spectral scanning, without any mechanical elements and it has the luminosity and resolution properties of other interferential spectrometers. A description is given. (MOW)

16184 LANGMUIR PROBE AND OPTICAL SPECTROSCOPY FOR ELECTRON TEMPERATURE MEASUREMENT. Fabry, M.; Cussenot, J. R.; Numano, M. (Univ., Nancy). pp 447 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

In earlier experiments, it was shown that spectroscopic temperature measured from relative line intensities agrees with those given by Langmuir probes. It is shown here that this agreement is not always true. (MOW)

16185 TWO FREQUENCIES HCN INTERFEROMETER. Belland, P.; Veron, D. (CEN, Fontenay-aux-roses, France). pp 450 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

When dealing with transient plasmas, fractional fringe shift measurement is difficult. By using particular techniques, it is possible to refer to time interval measurement instead of amplitude variation measurement. Then, higher precision can be achieved. In the experiment described, this result is obtained by using two frequencies, i.e., the frequency of the reference beam is slightly Doppler-shifted with respect to the probing beam. The phase shift introduced by the plasma is thus transferred to the output signal at the beat frequency, whose value sets the time resolution of the interferometer. (auth)

16186 HOMODYNE DETECTION OF LASER LIGHT SCATTERED BY A THETA PINCH PLASMA. Wooding, E. R. (Culham Lab., Abingdon, Eng.); Yeoman, M. L.; Evans, D. E. pp 451 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Pulsed ruby laser light scattered at angles near 1° to the incident beam by sound waves in a liquid have been detected and spectrally analyzed by beating with radiation at the original frequency from the laser. An experiment on the same principle conducted with a theta pinch plasma ($T_e \sim 20$ eV, $N_e \sim 10^{16}$ cm^{-3}, 50 mtorr D_2) in which beat signals were measured at 680 MHz is discussed. (MOW)

16187 MEASUREMENT OF MAGNETIC FIELDS IN HIGH-TEMPERATURE TENUOUS PLASMAS BY LIGHT-SCATTERING FROM A RUBY LASER. Forrest, M. J.; Muroaka, K.; Peacock, N. J. (Culham Lab., Abingdon, Eng.). pp 452 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sept 1973). See CONF-730906-(P1).

Evans (1970) and Kellerer (1970) have observed modulation of the spectrum of incoherently scattered ruby laser light at multiples of the electron cyclotron frequency, ω_{ce}, in a magnetized plasma. An extension of this technique is described for the measurement of the intensity and direction of magnetic fields in more tenuous, higher-temperature plasmas, where detection of modulation at a single frequency in the scattered spectrum is difficult due to photon statistics. (MOW)

16188 NUMERICAL INVESTIGATION OF THE INFLUENCE OF COLLISIONS OF THE PEAK STRUCTURE OF THE INCOHERENT SCATTERING SPECTRUM OF A LASER BEAM THROUGH A MAGNETIZED PLASMA. Leclert, G.; Meyer, R. L. (Laboratoire de Physique des Milieux Ionises, Nancy). pp 453 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The influence of electron-neutral collisions on the scattered spectrum was studied. The plasma is homogeneous infinite, singly charged ions insure the electrical neutrality. The electron and ion velocity distributions are assumed to be Maxwellian. The external magnetic field is static and uniform. The realistic case was studied for a nitrogen reflex discharge (density $N_0 = 10^{18}$ particles/m^3, electronic temperature $T_e = 3 \times 10^4$°K, ionic temperature T_i = 500°K) analyzed by means of an ionized argon laser beam (λ_i = 4880 Å). The scattering angle is fixed at 90° while the angle θ between applied magnetic field $\vec{B}_0$ and scattering wave vector $\vec{k}$ is 87° ($\vec{k} = \vec{k}_i \pm \vec{k}_s$, $\vec{k}_i$ and $\vec{k}_s$ being respectively incoming and scattered wave vectors). (MOW)

16189 NEW METHOD OF PLASMA ELECTRON DENSITY MEASUREMENT BY A LASER. Kosin, G. I.; Konovalov, N. A.; Nikulin, E. S.; Protsenko, E. D.; Savyolov, A. S.; Telkovskii, V. G. (Moscow Physical Engineering Inst.). pp 455 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A method is discussed for plasma density determination using laser radiation. This method is based on the use of two axial modes of the He-Ne laser. A brief discussion of the experimental results is given. (MOW)

16190 DETERMINATION OF ELECTRON DENSITY PROFILE OF THE INHOMOGENEOUS PLASMA CYLINDER BY REFRACTION TECHNIQUE. Tishchenko, E. A.; Zatsepin, V. G. (Inst. for Physical Problems, Moscow). pp 456 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

This work was undertaken to determine the electron density of the UHF discharge at high pressure. The difficulties of the submillimeter diagnostics of the plasma filament, the diameter of which is not much more than the width of the probing beam, necessitated the development of a new technique for treating the experimental data on the transmission of microwave radiation by plasma. The well known method of studying the electron density profiles by refraction requires measurements of the angular distribution of the refracted radiation to deduce the information on the profile. In some cases these measurements are difficult. Irregular motion of the investigated plasma column across the microwave beam complicates the problem even more, but at the same time this motion makes it possible to measure the dependence of transmission T at various impact parameters ρ of the microwave beam and plasma axes. (MOW)

16191 ACTIVE SUBMILLIMETER DIAGNOSTICS OF THE MOVING UHF DISCHARGE IN DEUTERIUM AT HIGH PRESSURE. Kapitza, P. L.; Tihchenko, E. A.; Zatsepin, V. G. (Inst. for Physical Problems, Moscow). pp 457 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

An arrangement for obtaining the investigated UHF discharge at high pressure was described previously. Measurements of the radiation spectrum of plasma in the far infrared region revealed that electron density of the inner part of the discharge was about 5×10^{15} to 10^{16} cm^{-3}. The active diagnostics experiments were performed to obtain more exact data on the electron density and its spatial distribution. The transmission and reflection of microwaves by a plasma column were measured in the range of wavelengths of 0.3 mm to 0.7 mm at gaseous pressures of 1 to 2 atm and input UHF power from 4 to 12 kwt. (MOW)

16192 SYNCHROTRON RADIATION SPECTRUM NEAR THE ELECTRON CYCLOTRON FREQUENCY AND ITS FIRST HARMONIC, DEDUCTION OF THE ELECTRON DISTRIBUTION FUNCTION. Jacquinot, J.; Poffe, J. P.; Waldes, J. (CEN, Fontenay-aux-Roses, France). pp 459 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A diagnostic method for the determination of the energy distribution function is based on the synchrotron radiation spectrum near the electron cyclotron frequency. This method was extended and improved by performing measurements at both the fundamental frequency and its first harmonic and by attempting an absolute calibration of the plasma emissivity. The basic limitations and advantages of the method are discussed. (MOW)

16193 SPECTRAL TECHNIQUES FOR EXPERIMENTAL INVESTIGATION OF PLASMA DIFFUSION DUE TO POLYCHROMATIC FLUCTUATIONS. Powers, E. J. (Univ. of Texas, Austin). Nucl. Fusion; 14: No. 5, 749-752(Nov 1974).

A description is given as to how digitally implemented spectral analysis techniques may be utilized to experimentally investigate the relationship between plasma fluctuations and transport across confining magnetic fields. The starting point is the following expression for the time-averaged particle flux: $\langle \tilde{n}\,\tilde{v} \rangle = \langle \tilde{n}\,\tilde{E} \rangle / B$ where $\tilde{n}$ and $\tilde{E}$ are the fluctuating density and electric field, respectively. The static magnetic field is denoted by B, while the pointed brackets denote a time average. (MOW)

16194 TOKAMAK DIAGNOSTICS WITH THE 496-μm CH_3F LASER. Jassby, D. L. (Princeton Univ., NJ). Nucl. Fusion; 14: No. 5, 745-747(Nov 1974).

A brief description of the Thomson scattering technique for measuring ion temperatures in tokamak plasmas using one Joule of 496-μm radiation is given. The use of this radiation to measure transverse thermal conductivities is also discussed. (MOW)

16195 MULTICHANNEL DIGITAL SPECTROMETER FOR MEASURING THE ION TEMPERATURE IN A RECURRENT PLASMA. Clement, M.; Moulin, B.; Stevenin, P. (CEN de Grenoble, France). Rev. Phys. Appl.; 9: No. 4, 743-748(Jul 1974). (In French).

A multichannel digital spectrometer was designed for the evaluation of the ionic temperature in recurrent plasma. The Fabry–Perot interferometric disperser, the 12 spectral channels, and the digital system for storage and output of the results were chosen because of the high sensitivity requirements (very weak light from the plasma) and the flexibility of the digital electronics. The problem of error given by a multichannel spectrometer is discussed and compared to the experimental results obtained after smoothing. Finally, the first results of measurements from the CIRCE 25 kW device are presented. (FR)

16196 ORIFICE PROBE FOR PLASMA DIAGNOSTICS. Prokopenko, S. M. L. Toronto; York Univ. (1973). 153p.

Thesis.

An orifice probe is described consisting of a hole in a thin metal diaphragm separating a bulk plasma from a low-pressure detection region where a collector and a selected number of grids are mounted. It is used to determine conventional plasma parameters including the charged particle densities, the electron temperature, an upper bound for the ion temperature, and the space potential. In addition, it can be used to estimate the metastable number density for the same plasma. Also, quantities concerned with the physics of charged particle collection can be evaluated, including a secondary electron emission coefficient for fast electrons ($\gtrsim$ 30 eV) from the grids, a reflection coefficient from the grids for slow electrons ($\lesssim$ 30 eV), a reflection coefficient for electrons from the roughened collector surface, and transparencies of grids to electrons and to metastables and photons. Experiments are described for low-pressure (< 20 μ) RF plasmas in argon operating at 120 MHz with discharge powers < 75 W. The orifice probe analysis is deliberately approached at different levels of sophistication. The simplest involves a minimal number of grids and the analysis of the total current characteristic to obtain the bulk plasma parameters. At a more refined level, a multi-grid orifice probe and analysis techniques are presented which also permit the determination of additional parameters and in situ evaluation of instrumental parameters. (CA)

16197 LASER INTERACTIONS WITH PLASMAS. Lax, B. (Massachusetts Inst. of Tech., Cambridge). pp 100-101 of Optoelectronics and Laser Technology. New York; Inst. of Electrical and Electronics Engineers, Inc. (1974).

From 6th conference on optoelectronics and laser technology; Albuquerque, NM (24 Apr 1974).

Research in the field of laser interactions with plasmas is reviewed. Special attention is given to methyl fluoride laser beams whose application to tokamak plasma diagnostics makes possible thermal conductivity measurements through depositing of large amounts of energy in a small region of the plasma and monitoring the flow of energy from the deposition point. Other possible experiments are briefly reviewed. (IAA)

16198 A SIMPLE x-RAY MICROSCOPE FOR PHOTOGRAPHING LASER PRODUCED PLASMAS. Seward, F.D.; Palmieri, T.M. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Rev. Sci. Instrum. 46: No. 2, 204-206 (Feb 1975).

We have built two simple x-ray microscopes and have used these instruments to take x-ray pictures of laser produced plasmas. The sensitive range is 0.2 -8 keV with greatest sensitivity from approximately 0.5-2 keV. For low energy x rays the resolution is better than that which can be obtained with a pinhole camera. (auth)

16199 CAPPED PROBE FOR ION TEMPERATURE DIAGNOSTIC IN A MAGNETIZED PLASMA. Sato, M. (Department of Electrical Engineering, Yamagata University, Yonezawa, Japan). Phys. Fluids 17: No. 10, 1903-1909 (Oct 1974).

A simple ion temperature measurement method in a magnetic field using an electrostatic capped probe is presented and tested. The probe with the axis oriented parallel with the magnetic field is a small cylinder whose flat tip is insulated with a cap to inhibit electron inflow parallel to the field. The ion collector current, essentially less affected, becomes comparable to or larger than the saturation electron current, and the usual retarding potential technique can be used to measure ion temperature. Measurements were made in a diffused helium plasma with the density $10^{10}\sim10^{13}$ cm^{-3} at the gas pressure ~mTorr and the field 0.8~3.5 kG. Ion temperatures obtained are 0.8~2 eV, which nearly equal electron temperatures, and are compared with data from the ion probe and Doppler profile measurements. Availabilities of the method and limiting conditions for the temperature determination are also discussed. (auth)

16200 CONVERSION OF NEUTRAL HYDROGEN INTO PROTONS IN DENSE PLASMAS. Bazilevskaya, T.A.; Krupnik, L.I.; Shulika, N.G. Sov. Phys.-Tech. Phys. 19: No. 6, 741-744 (Dec 1974).

The efficiency of conversion of neutral hydrogen atoms with energies from 300 to 10000 eV into protons by passage through plasma fluxes produced by a conical plasma injector with a pulsed hydrogen supply is studied. The plasma target density varies from 10^{12} to 10^{14} particles/cm^3. The efficiency of conversion into protons is compared for gaseous and plasma targets. (auth)

16201 ABSORPTION OF HIGH FREQUENCY ELECTROMAGNETIC FIELD AS A FUNCTION OF DISCHARGE CURRENT IN THE IONOSPHERE COMPONENTS, AS A DIAGNOSTIC METHOD FOR THE PLASMA OF THESE GASES. Pechiu, P. (Observatoire Astronomique, Bucharest). Rev. Roum. Phys.; 19: No. 7, 669-685(1974). (In French).

A method is given of diagnosing the plasma by means of a study of the high frequency conductance of a few ionized gases, as a function of the discharge current "i", in the main as a function of energetic conditions; the study is effected with regard to various parametric conditions. (auth)

Plasma Kinetics (General)

16202 (NP-20243) ANNUAL REPORT, 1973. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). 1973. 230p. (In German). Dep. NTIS (US Sales Only) $14.50.

The experimental and theoretical studies and results in the areas of plasma physics, data processing, plasma-wall interactions, and relativistic plasmas are briefly summarized. The publications in journals and at conferences resulting from these studies are tabulated. (JSR)

16203 ELEVENTH INTERNATIONAL CONFERENCE ON PHENOMENA IN IONIZED GASES, PRAGUE, CZECHOSLOVAKIA, SEPTEMBER 10-14, 1973. Contributed Papers. Stoll, I.; Datlov, J.; Ferdinand, J.; Jakubka, K.; Krejci, V.; Laska, L.; Piffl, V.; Sedlacek, Z. (eds.). Prague; Czechoslovak Academy of Sciences (1973). 352p. (CONF-730906-(P1)).

A separate abstract was prepared for each of 104 papers presented at the conference. (MOW)

For abstracts of individual papers see: 16152, 16153, 16168-16192, 16204, 16210, 16216, 16217, 16230-16238, 16246-16257, 16286-16332, 16348, 18107-18109, and 18177.

16204 INDUCTIVE PLASMA ACCELERATION WITH NON-SINUSOIDAL ELECTROMAGNETIC STANDING WAVES. Koehne, R.; Meert, A. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt eV, Stuttgart). pp 364 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th International Conference on Phenomena in Ionized Gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Plasmoid velocities were measured in three different linear coils. For comparison the energy stored in the capacitor battery was maintained constant. The data are described. (MOW)

16205 ELEVENTH INTERNATIONAL CONFERENCE ON PHENOMENA IN IONIZED GASES, PRAGUE, CZECHOSLOVAKIA, SEPTEMBER 10-14, 1973. Invited Papers. Pekarek, L.; Laska, L. (eds.) Prague; Czechoslovak Academy of Sciences (1973). 539p. (CONF-730906-(P2)).

Thirteen papers are included on various aspects of low-temperature plasmas. The topics discussed are mainly atomic processes in plasmas. (MOW)

16206 ION VELOCITY DISTRIBUTION IN A TOROIDAL PLASMA. Stringer, T. E. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Nucl. Fusion; 14: No. 5, 685-693 (Nov 1974).

The ∇B drift in the toroidal magnetic field leads to relatively large radial displacements as the parallel velocity of an ion passes through zero. If collisional scattering into this velocity band is unable to balance the enhanced radial diffusion, a minimum will develop in the velocity distribution. This happens when $\epsilon\rho_\theta/r_n > (r\nu_i/v\Theta)^{1/2}$, where $\epsilon = r/R$ is the inverse aspect ratio of the torus, $\Theta = B_\theta/B_\varphi$ is the ratio of poloidal and toroidal components of the magnetic field, $v = (2T/M)^{1/2}$ is the ion thermal speed, $\rho_\theta = Mv/eB_\theta$ is the ion Larmor radius in the poloidal magnetic field, r_n is the density scale length, and ν_i is the ion-ion collision frequency. As $\epsilon\rho_\theta/r_n$ increases, the minimum deepens, and beyond $(r\nu/v\Theta)^{1/2}$ the distribution has a loss-band character. The analysis is restricted to the "plateau" collisional regime. The velocity distribution is derived by solving the collisional kinetic equation, including the radial loss and an isotropic source term. The radial loss term is dominant only over a limited velocity band, the resonant band. Solutions valid within the resonant and non-resonant velocity ranges are matched at the transition between these ranges. For typical Tokamak parameters, the predicted anisotropy in the ion velocity distribution is very weak, being of order 1%. However, it should be quite strong in existing stellarators. Observations in the Proto-Cleo stellarator are not inconsistent with theoretical predictions. (auth)

16207 CALCULATION OF THE PARAMETERS OF THE PLASMA FORMED IN PENNING MIXTURES OF URANIUM FISSION FRAGMENTS. Batyrbekov, G. A.; Pel'menshtein, B. Ya.; Takibaev, Zh. S. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 4, 37-41(1974). (In Russian).

The parameters of the plasma formed in Penning mixtures ([Ar] : [Ne] = 10^{-4}) during irradiation with uranium fission fragments were calculated for neutron fluxes up to 10^{14} n/cm^2 sec. The dependence of the electron density n_e on the gas pressure P at interconsistent values of the electron temperature T_e and electron density n_e was shown for two values of the neutron flux, i.e., 10^{13} and 10^{14} n/cm^2 sec. The dependence of the electron temperature on the gas pressure and the neutron flux was also investigated. The maximum electron density equaled $\approx 1.5 \times 10^{-13}$ cm^{-3} for gas pressures of ≈100 torr, neutron flux of 10^{14} n/cm^2 sec, and gas temperature of 600°K. (tr-auth)

16208 VORTEX: A QUASI-STEADY SUPERMAGNETOSONIC ROTATING PLASMA EXPERIMENT. Srnka, L. J. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Plasma Phys.; 16: No. 12, 1129-1145(Dec 1974).

A rotating plasma experiment has been built which produces a stable, reproducible, supermagnetosonic flow in highly ionized argon. The rotation is produced by a radial electrical discharge (peak current 40 kA) across a vertical magnetic field (B_z up to 0.2T). A preheat discharge gives uniform starting conditions for the flow. The flow velocity exceeds the limit predicted for argon by the Alfven critical velocity theory. Magnetosonic mach numbers up to 2.0 and flow times of 0.5 msec are obtained. The VORTEX plasma is used to model some aspects of the solar wind flow past bodies in the solar system. (auth)

Plasma Kinetics (Experimental)

16209 (CONF-740522-, pp 531-535) FUSION REACTIONS IN COLLIDING BEAMS. Blewett, J. P. (Brookhaven National Lab., Upton, NY). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Two colliding beam configurations are presented in which fusion reactions can take place between deuterons and tritons. The first is a linear system in which the ion beams travel in the same direction and are focused by a collinear electron beam. In the second configuration the ions travel in a spiral path in a strong magnetic field and are focused by electrons travelling along the lines of force of the magnetic field. The first system yields very little power but the second appears to merit further attention. (auth)

16210 DIRECT REGISTRATION OF A PLASMA BEAM REFLECTED BY A NONHOMOGENEOUS MAGNETIC FIELD WITH LOCAL ECR. Golovanivskii, K. S.; Pokhmelnykh, L. A. (Moscow State Univ.). pp 360 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The reflection of a moving plasma by a longitudinal inhomogeneous magnetic field superimposed by a hf electrical field under the conditions of electron cyclotron resonance was first demonstrated experimentally with the plasma flowing in a pulse regime. The effect of reflection of a stationary stream of plasma by combined fields with local ecr and the comparison of the properties of the incident and the reflected plasma beams were studied. (MOW)

16211 IDENTIFICATION OF THE SPECTRA OF LASER PLASMAS OF LITHIUMLIKE IONS OF Ti, V, AND Cr IN THE 8.5–17 Å RANGE. Aglitskii, E.V.; Boiko, V.A.; Pikuz, S.A.; Faenov, A.Y. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). Sov. J. Quantum Electron. 4: No. 8, 956-962 (Feb 1975).

A large number of the spectral lines of lithiumlike ions of Ti, V, and Cr emitted by laser plasmas were identified. The occurence of transitions from high ($n = 4-9$) levels made it possible to determine experimentally the ionization potentials of TiXX, VXXI, and CrXXII. A comparison of the experimental and theoretical wavelengths indicated that the calculated results could be used in predicting the properties of ions with higher values of Z (in particular, FeXXIV). The results obtained should be useful in astrophysical and spectroscopic applications and in obtaining information on the physical conditions in hot laser plasmas. (auth)

Plasma Kinetics (Theoretical)

16212 (EUR-CEA-FC-722) MOTION OF CHARGED PARTICLES IN MAGNETIC AND ELECTRIC FIELDS IN A TOROIDAL COLLISIONLESS PLASMA. Maschke, E. K.; Tagger, M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). May 1974. 72p. (In French). Dep. NTIS (US Sales Only) $6.75.

An adiabatic movement integral describing the drift surfaces is used systematically to describe the properties of the motion of an individual particle in magnetic and electric fields. The formulas which describe the exact motion of the particle and the motion of the guide center are presented, after which the particle tracks in axisymmetrical fields are studied in detail. The case of a stationary configuration where there is little or no current density parallel to the field and no toroidal electric field is considered first. The only electric fields involved have equipotential surfaces coinciding with the magnetic surfaces. Since the configuration is axisymmetrical and independent of time, the drift equations then have a prime integral describing the drift surfaces. The axisymmetrical Tokamak configuration is considered next. The Hamiltonian of the system no longer possesses the invariances of the previous case because of the presence of a toroidal electric field which may be described either by a time-dependent vector potential or by a multiform scalar potential. In addition, the existence of a current density parallel to the field give rise to additional terms in the drift equation. It is shown that by neglecting in these equations a second order term with respect to the Larmor radius, and within the limits of a very weak toroidal electric field, the same expression is obtained for the drift surfaces as in the absence of parallel current. The tracks in an elliptical-section Tokamak are then described briefly and the effect of the toroidal electric field (Ware's effect) is discussed. (FR)

16213 (EUR-CEA-FC-743) VOLUME POWER EXPANSION OF HYDROMAGNETIC EQUILIBRIA. Bouligand, G. M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). May 1974. 11p. Dep. NTIS (US Sales Only) $4.00.

In the literature of plasma physics, the hydromagnetic equilibrium equations generate expansions in entire power series of the distance ρ from the axis. Similarly, here, it is shown that it is possible, with the same difficulties in principle, to form expansions within a Hamada coordinate system in successive powers of $V^{1/3}$ (where V is the volume bounded by a closed magnetic surface). (FR)

16214 (JINR-P11-8245) ADEQUACY OF A MATHEMATICAL SIMULATION OF COMPLEX SYSTEMS BY SIMPLIFIED ONES (MACROPARTICLE METHOD). Makhankov, V. G.; Pollyak, Yu. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

By the example of a numerical simulation (macroparticle method) of the processes taking place in plasma and electron beams, the possibility of obtaining the criteria of adequacy of such models to the initial physical systems is studied. General approaches to checking the simulation accuracy were considered. (auth)

16215 (UCRL-51725) GUIDING-CENTER SIMULATION OF TOROIDAL PLASMAS. Johnson, T. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Dec 1974. Contract W-7405-eng-48. 291p. Dep. NTIS $17.75.

Thesis.

A new computer simulation method for axisymmetric toroidal plasmas is developed. The method comprises two separate physical models representing different components of an experimental plasma. The first model is an MHD fluid equilibrium representation; the technique devised for the solution of this equilibrium is several times faster than any currently in common use. The second model is a macroparticle representation which uses guiding-center formalism for the particles' velocities and positions; consequently, the timestep used by this model may be many times longer than those possible for conventional macroparticle simulations. A new computer code, GUIDON, which incorporates these models with solution for self-consistent magnetic fields, is presented. Special features of the guiding-center model are discussed in detail. Results of simulations using GUIDON are also presented. The major effort involves design simulation of the proposed Two-Component Torus (TCT) prototype reactor. Further results describing the SPIRE toroidal electron pinch accelerator, the Ware drift in Tokamaks, and a Physics International Corp. electron beam drift torus are presented. (auth)

16216 EQUATIONS FOR HIGHER ORDER APPROXIMATIONS TO DISTRIBUTION FUNCTIONS AND MACROSCOPIC QUANTITIES FOR A FULLY IONIZED PLASMA IN A MAGNETIC FIELD. Oien, A. H. (Univ. of Bergen). pp 264 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Kinetic and macroscopic equations for a two-component fully ionized plasma in an external electromagnetic field are derived up to an order of approximation corresponding partly to that of Burnett. Some solutions are obtained. (auth)

16217 PLASMA TRAPPING IN THE BEAM–PLASMA SYSTEM. Astrelin, V. T.; Buchelnikova, N. S. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 392 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The PIC-method is used in the investigation of a one-dimensional system with the length $L = 200\ r_d$ (r_d is the Debye radius) and periodic boundary conditions is divided into cells with Ir_d length. Stationary ions are considered as a stable homogeneous background. Plasma and beam electrons are represented by a number of space-weighted simulating particles with the same ratio e/m as for real electrons but beam particles and particles of the plasma tail near the beam are more light (and respectively have smaller charge) for the best approximation of the Maxwellian distribution function. The size of particles is equal to Ir_d. (MOW)

16218 TOROIDAL PLASMA EQUILIBRIA IN AN OPEN SHELL WITH CURRENT-CARRYING CONDUCTORS. Kitsunezaki, A.; Maeda, H.; Shimomura, Y. (Japan Atomic Energy Research Inst., Tokai). Nucl. Fusion; 14: No. 5, 747-749(Nov 1974).

Toroidal plasma equilibria in a conducting shell with a poloidal opening in the presence of current-carrying conductors are obtained by numerical calculation. A three-stage iteration scheme was used in the calculation. An artificial second shell is introduced in the calculations. As the boundary condition, the ψ values determined by the plasma current, currents through the conductors and induced currents in the shell are taken to be a given constant on each shell. The volume inside the second shell is divided into several parts in the analysis. (MOW)

16219 SOME ASPECTS OF THE STATISTICAL PHYSICS OF RELATIVISTIC PLASMAS. Brenig, L. Brussels; Univ. Brussels (1974). vp. (In French). Centre d'Etude de l'Energie Nucleaire, Mol, Belgium.

Thesis.

How does one reconcile the isotropy of relativistic time considered as a geometric coordinate and the irreversibility of thermodynamic evolution where time plays the role of a parameter? Another important problem is that of the hydrodynamic description of an inhomogeneous plasma: Is it possible to characterize, in a covariant way, the inhomogeneity of a system and to construct an invariant form of the hydrodynamic equations? Associated with this latter question there arises the questions of the microscopic justification of the hydrodynamic equations of a plasma and of the miroscopic calculation of the phenomenological transport coefficients which are injected. The purpose of this work was to give an answer to each of these three questions. (tr-auth)

16220 TRANSPORT PROCESSES IN TOKAMAK-TYPE INSTALLATIONS IN TWO-FLUID APPROXIMATION. Kovrizhnykh, L. M. (Lebedev Inst. of Physics, Moscow). Nucl. Fusion; 14: No. 5, 715-725(Nov 1974).

Transport processes across a strong magnetic field in axisymmetric magnetic traps are studied in two-fluid magnetohydrodynamics with anisotropic temperature. Account is taken of inertia and collisional viscosity, and of the nonuniformity of the equilibrium temperatures. In the case of low toroidality $r/R \ll 1$, expressions are obtained and analysed for the heat and particle fluxes, and equations are obtained for the ambipolar electric field, the mean velocity of the plasma, and the electric current along the magnetic field lines. (auth)

16221 FIELD PENETRATION INTO A PLASMA WITH NONLINEAR CONDUCTIVITY. Lonngren, K.E.; Ames, W.F. (University of Iowa, Iowa City, Iowa 52242); Hirose, A.; Thomas, J. Phys. Fluids 17: No. 10, 1919-1920 (Oct 1974).

A nonlinear diffusion equation describing electric field penetration into a plasma with a nonlinear conductivity has been solved. The penetration time becomes shorter as the nonlinearity increases. (auth)

16222 EFFECT OF LOCALIZED ELECTRIC FIELDS ON THE EVOLUTION OF THE VELOCITY DISTRIBUTION FUNCTION. Morales, G.J.; Lee, Y.C. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. Lett. 33: No. 26, 1534-1537 (23 Dec 1974).

The interaction between charged particles and sharply localized fields is investigated. The random particle scattering is described by a Fokker–Planck equation whose time–dependent solution exhibits the formation of a highly populated superthermal tail. (auth)

16223 TRANSPORT OF ENERGY BY CHARGED PARTICLES IN A LASER PLASMA. Gus'kov, S.Yu.; Krokhin, O.N.; Rozanov, V.B. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). Sov. J. Quantum Electron. 4: No. 7, 895-898 (Jan 1975).

An analysis is made of the transport of energy by charged particles in a high–temperature laser plasma, with particular attention to α particles produced by the deuterium–tritium reaction. The distribution function of the α particles is obtained by solving the transport equation for a spatially inhomogeneous plasma. An approximate method is developed for the calculation of the distribution function and other quantities of physical interest. A satisfactory agreement is obtained between the exact and approximate solutions. (auth)

16224 KINETICS OF THE FORMATION OF MULTIPLY CHARGED IONS. Reshetnyak, S.A.; Shelepin, L.A. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). Sov. J. Quantum Electron. 4: No. 8, 969-973 (Feb 1975).

An analytic quasisteady function is obtained for the distributions of multiply charged ions in accordance with their degree of ionization. This function depends on the electron temperature T_e, electron density N_e, and a parameter κ. The dependence of κ on time is determined and the relationship of this parameter to the initial conditions is found. This makes it possible to describe the dynamics of formation of multiply charged ions. A specific example of the ionization and recombination of multiply charged aluminum plasma is considered and the relevant distribution functions are calculated. (auth)

16225 SYMMETRY OF HIGH–FREQUENCY PLASMA MOTIONS. Zhmudskii, A.A.; Taranov, V.B. (Institute of Nuclear Research, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. Phys.–Tech. Phys. 19: No. 6, 717-718 (Dec 1974).

The high–frequency motion of a plasma is analyzed on the basis of the one–dimensional single–fluid model taking account of the finite electron temperature. The symmetry of the equations is analyzed by the theory of continuous transformation groups. Since the equations are invariant under a transformation to a coordinate system oscillating at the plasma frequency, equations for generalizing the solutions can be derived. In particular, generalization of traveling–wave solutions leads to new solutions in which the phase as a linear function of the time is supplemented by a term which oscillates at the plasma frequency and in which the velocity and electric field are supplemented by terms which result from the noninertial nature of the oscillating coordinate system. (auth)

16226 RESONANCES IN LIGHT SCATTERED FROM A PLASMA IN A MAGNETIC FIELD. Peratt, A.L. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 18: No. 1, 57-66 (Jan 1975).

Expressions are developed for the electron density fluctuation spectrum for monochromatic radiation incident upon a magnetized plasma in thermal equilibrium. The method is based upon the full–wave derivation of a formal relation between the autocorrelations of particle density and dielectric tensor. Collisions are introduced into the formulation via a BGK and a Fokker–Planck collision term in the Boltzmann equation. An enhancement of the scattered spectra due to the excitation of longitudinal slow–wave resonances is predicted when the differential scattering vector is aligned primarily perpendicular to the magnetic field, provided that the collision–to–cyclotron frequency ratio satisfies the relation $\nu/\Omega < 1$ in the BGK model or $\nu/\Omega < \Omega^2 m/k^2 KT$ in the Fokker–Planck model. (auth)

16227 CURRENT SHEET OBSERVATIONS IN A SMALL THETA PINCH. Yarborough, W.W.; Barach, J.P. (Physics Department, Vanderbilt University, Nashville, Tennessee 37203). Phys. Fluids 18: No. 1, 105-108 (Jan 1975).

Magnetic field coil measurements are taken in a small theta pinch operated in helium with a capacitor bank energy of 1500 J. The divided pinch coil was connected series antiparallel so that a cusped magnetic field was produced. Plots of current density, magnetic field, and $J \times B$ force density are obtained and interpreted via a generalized Ohm's law. A substantial magnetic field overshoot occurs and is explained in terms of the plasma kinetic energy producing paramagnetic currents via the motional electromotive force. Force density plots of the pinch chamber exhibit a surface of shear in the magnetic force on the plasma which is unusual and suggestive. (auth)

Plasma Production

Refer also to abstracts 16168, 16211, and 16398.

16228 (LA-UR-74-1883) CARBON DIOXIDE LASER DEVELOPMENT AND ASYMMETRY IN LASER DRIVEN IMPLOSIONS. Benjamin, R. F.; Boyer, K.; Farnum, E. H.; Fenstermacher, C. A.; Fries, R. J.; Giovanielli, D. V.; Godwin, R. P.; Lieber, A. J.; McCall, G. H.; Stratton, T. F. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 16p. (CONF-741105-50). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

A brief description is given of the CO_2 laser amplifiers at Los Alamos. They are based on the generation of controlled discharges in suitable gas mixtures through the application of external electron beams as the ionizing agent with electrical excitation of the lasing molecules provided by a second, nonsustaining discharge. Some experimental results showing asymmetry in laser driven implosion of hollow shells are described. (MOW)

16229 (LBL-3097) STUDY OF AN ISOLATED, LASER-PRODUCED DEUTERIUM PLASMA IN A MAGNETIC FIELD. Jarboe, T. R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1974. Contract W-7405-eng-48. 103p. Dep. NTIS $8.25.

Thesis.

Apparatus is described which produces 50 μ deuterium pellets. The pellets are sliced from a continuously spun solid deuterium thread at a rate of up to 10 pellets/sec. The methods of thread production, slicing, and pellet collimation are discussed. Techniques for detection and irradiation, on one side, of these freely falling pellets with a fast rising ruby laser pulse are also described. It is found that the freely expanding plasma has an asymptotic density distribution which is shell like. The observed burn time, expansion velocity, and asymptotic density distribution are found to be in good agreement with a simple model of the burning and acceleration of the pellets. The total number of ions produced is ~5 × 10^{15} consistent with complete ionization of the 50 μ pellets. The plasma is given on the order of 100 eV per particle when the laser energy flux is 10^{12} watts/cm^2. This plasma is also created in a magnetic field and its total mass and energy are measured by a large non-interacting magnetic loop probe and are found to be consistent with that measured by a large charge collector. The plasma motion perpendicular to the magnetic field is arrested with little or no actual plasma bouncing observed. This strong damping seems to be caused by either turbulent mixing or anomalous resistivity or both. The plasma appears to be elongated in the direction of the laser beam and the flux exclusion of the plasma is seen to decrease by only a factor of about 2 immediately after peak. These effects seem to be caused by the initial density asymmetry and are shown to be consistent with a simple asymmetric expansion model. (auth)

16230 INVESTIGATION OF NEUTRON AND X-RAY RADIATION AND GASODYNAMIC PARAMETERS OF LASER PLASMA. Aglitskii, E. V.; Basov, N. G.; Boiko, V. A.; Zakharov, S. M.; Krokhin, O. N.; Sklizkov, G. V. (Lebedev Inst. of Physics, Moscow). pp 253 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The physical conditions of laser-produced plasmas were studied. Oscillograms of the temporal evolution of neutrons and x radiation from a CD_2 target upon irradiation by intense laser radiation are shown. Both thermal and delayed neutrons were observed. (MOW)

16231 DETERMINATION OF CERTAIN PARAMETERS OF THE MICROPLASMA OBTAINED THROUGH THE ACTION OF LASER RADIATION ON A SOLID SAMPLE IN AN ARGON MEDIUM AND WITH TIME-RESOLUTION OF THE SPECTRUM. Dimitrov, G.; Petrakiev, A.; Gagov, V. (Univ., Sofia). pp 255 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

For the same parameters of the discharge chain a different duration of the discharge was observed depending on the atmosphere in which it took place. Certain changes were observed also in the character of the action of the laser radiation on the material of the sample. With L = 0 μH, for instance, the duration of the discharge (which is aperiodic) is 120 μsec in air-atmosphere and 150 μsec in argon. Such a lengthening of the discharge and the glow of the lines in argon atmosphere is also observed in self-induction, L = 30 μH. The spectrograms are described. (MOW)

16232 MECHANISM OF LASER-INDUCED GAS IONIZATION AND BREAKDOWN. Panarella, E. (National Research Council, Ottawa). pp 256 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A solution is given for the problem of laser-induced gas ionization. The solution is based upon the assumption that, at the focus of a lens where the ionization process takes place, some nonlinear effect between laser radiation fields might occur, as predicted by quantum electrodynamics and the classical photon energy expression $\epsilon = h\nu$ might have to be replaced by an expression of the type $\epsilon = h\nu/[1-\beta_\nu f(I)]$, where f(I) is a function of the light intensity and β_ν is a coefficient whose product with f(I) significantly differs from zero only in the case of high intensity laser light. (MOW)

16233 INTERACTION OF A TEA–CO_2 LASER WITH THIN FOILS. Martineau, J.; Bonnier, A.; Parbhakar, K. J. (INRS-Energie, Varennes, Quebec). pp 257 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Characteristic properties of plasma produced from thin aluminum foils by a 30MW, 100ns TEA, CO_2 laser are described. The thickness of the foil is a parameter and is varied from 1 to 150μm. The laser is a five element parallel electrode TEA type. The targets are mounted in a pyrex vacuum chamber evacuated to 10^{-5} torr. The laser radiation is focused on the target with a 5cm f/1 germanium lens placed inside the chamber. A TRW streak camera gives an overall view of the plasma dynamics, the plasma density distribution, and its time evolution is obtained by using a Mach-Zehnder interferometer and a pulsed (20 ns) ruby laser. (MOW)

16234 PRESSURE DEPENDENCE OF SPONTANEOUS MAGNETIC FIELDS IN A LASER-PRODUCED PLASMA. Cooper, A. W.; Bird, R. S. (Naval Postgraduate School, Monterey, CA). pp 258 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The space and time behavior of the fields produced by irradiation of an aluminium slab with 6 joule, 20 nsec (10^{10} W/cm^2) pulses of 1.06 micron radiation was studied in backgrounds of H_2, He, N_2, and Ar. An equation describing the time development of the magnetic field is obtained from the electron equation of motion. Various plasma density profiles are given. (MOW)

16235 SELECTIVE EXCITATION OF SODIUM ATOMS IN A DECAYING LASER-PRODUCED PLASMA. Richards, P. H.; Tozer, B. A. (Central Electricity Generating Board, Marchwood, Eng.). pp 259 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Experiments are described that demonstrate that selective excitation, in decaying plasmas produced by a laser beam on a metal surface, can be used to detect small numbers of impurity atoms in the surface. A tunable dye laser was used to demonstrate selective excitation of the sodium D lines. (MOW)

16236 EXPERIMENTAL AND THEORETICAL STUDIES OF MULTICHARGED IONS OF LASER PRODUCED PLASMA. Bykovskii, Yu. A.; Degtyarenko, N. N.; Elesin, V. F.; Kozyrev, Yu. P.; Kondrashov, V. E.; Lovetskii, E. E.; Polyanichev, A. N.; Sil'nov, S. M.; Sharkov, B. Yu.; Fetisov, V. S. pp 260 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The method of time-resolved mass-spectrometry was used in studies of spatial and energy distributions of multicharged ions of laser produced plasma. The experimental results reported were obtained with a Nd glass laser of 5 × 10^{13} W/cm^2. (MOW)

16237 STIMULATED BRILLOUIN EFFECT IN PLASMA. Ludek, A. (Czech Technical Univ., Prague). pp 261 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The interaction of light with ion-acoustic waves in a weakly ionized plasma is considered. A classical, coupled mode analysis is performed to determine the Brillouin laser threshold in gaseous plasma. The problem is solved by means of the hydrodynamic description of a weakly ionized plasma. (MOW)

16238 CO_2 LASER GENERATED SHOCKS ABOVE SOLID TARGETS. Emmony, D. C. (Loughborough Univ. of Tech., Eng.); Howson, R. P.; Willis, L. J. pp 262 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Strong shock wave formation in a gas above a solid target irradiated by a pulse from a Q switched laser has been reported previously. A near spherical luminous region believed to be shock heated gas was closely followed by a well defined sheath of material characteristic of the target. The sheath detached from the shock wave after several hundred nanoseconds. The time dependence of the first luminous front followed an $r \propto t^{3/5}$ law during the early stages of growth and then changed to a $t^{2/5}$ law or blast wave regime for the remainder of the luminous part of the expansion. One hundred ns pulses of CO_2 radiation E ~ 3J was used to initiate strong shocks near a solid target to extend the range of this technique. (MOW)

16239 ELECTRON BEAM FOCUSING AND APPLICATION TO PULSED FUSION. Yonas, G.; Poukey, J. W.; Prestwich, K. R.; Freeman, J. R.; Toepfer, A. J.; Clauser, M. J. (Sandia Labs., Albuquerque, NM). Nucl. Fusion; 14: No. 5, 731-740 (Nov 1974).

A review is given of recent work on the focusing of high-power relativistic electron beams in diodes. The physics of high-current relativistic electron beam focusing using plasmas in high-current diodes is studied experimentally and with computer simulation. The physics of the beam interaction with dense targets and the requirements for break-even are briefly discussed. (auth)

16240 LASER–DRIVEN FUSION. Brueckner, K.A.; Jorna, S. (KMS Fusion, Inc., Ann Arbor, Michigan 48106). Rev. Mod. Phys. 46: No. 2, 325-367 (Apr 1974).

The use of intense laser light to bring about thermonuclear reactions in a plasma is of considerable current interest. We present detailed analytical and computational studies which show the feasibility of laser–driven fusion. The required laser technology and the presently anticipated practical difficulties are discussed in outline. (auth)

16241 COHERENT PRODUCTION OF ENERGETIC ELECTRONS IN ANOMALOUS REFLECTION AND ABSORPTION OF INTENSE LASER LIGHT. Manheimer, W.M.; Klein, H.H. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Fluids 17: No. 10, 1889-1894 (Oct 1974).

The rate at which electrons are transported from the body to the nonthermal tail of the distribution function in the nonlinear stage of reflective and absorptive parametric instabilities is computed. The calculation is performed by conserving energy and momentum between waves and particles in the nonlinear regime. For the case of reflection, the reflection coefficient and energy flux of nonthermal particles are computed. It is found that the principal effect of the trapped electrons is to increase the density gradient length scale by as much as a factor of twenty five, at given reflection coefficient. For absorption, the rate of production of energetic particles is found. Also, the transport of energetic particles into the core of a laser fusion plasma is examined. (auth)

16242 LASER-NUCLEAR FUSION. Witkowski, S. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Phys. Unserer Zeit; 5: No. 5, 147-157(Sep 1974). (In German).

14 figs.; 2 tabs.; 4 refs.

The principle of the laser fusion reactor is explained. Following the presentation of the most important nuclear fusion reactions, the minimum required heating energy (Lawson-criterium) and the lifetime of the fusion plasma up to its destruction due to expansion are estimated, from which laser pulse capacity requirements result which are many orders of magnitude away from the lasers available today. The processes occurring in the irradiation of material with laser light (plasma production and expansion, propagating burn front and recoil wave in the plane and in the stamper model, crater formation, spherical material compression with lasers) are illustrated. The concept of a laser fusion reactor, the types of lasers available today as well as the light absorption mechanism in the plasma are dealt with. (GE)

16243 PLASMA-GENERATING APPARATUS AND PROCESS. Weissfloch, C. F.; Wertheimer, M. R.; Bosisio, R. G. British Patent 1,367,094/B/. 18 Sep 1974. 23p.

The arrangement described relates to a process for introducing high frequency microwave electromagnetic energy into a gaseous system so as to partially ionize the gas and maintain a stable large volume plasma. A major difficulty in the widespread use of microwave energy for generating plasma has been the lack of suitable applicators, all previously available applicators having been limited to very small plasma volumes. The object of the arrangement described is to increase the volume of achievable microwave plasmas, so that they can be used for treating large volumes of material. The apparatus employed uses a source of electromagnetic energy in the frequency range 100 to 30,000 MHz, a "slow wave structure" with an input end for applying such energy to a gas to produce a plasma, means for conveying the energy from the source to the input end, a suitable plasma container, and means for maintaining suitable conditions of pressure and gas flow in the container. Full constructional details are given. (UK)

16244 HIGH–VACUUM TRAPPING EXPERIMENTS ON THE ASTRON. Hester, R.E.; Porter, G.D.; Stallard, B.W.; Taska, J.; Walker, C.W.; Weiss, P.B. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 18: No. 1, 96-104 (Jan 1975).

Experimental results of high–vacuum (10^{-7} to 10^{-6} Torr) *E*–layer trapping experiments on the astron are presented. Both single and multiple pulse experiments are reported. The precessional mode is stabilized with a toroidal field. At sufficiently low pressures ($\lesssim 5 \times 10^{-6}$ Torr), *E* layers were observed to be stable for up to 200 msec. For greater times, the applied toroidal field had decayed sufficiently so that the layer was unstable to precessions. Axial compression of the layer was observed as it was neutralized by ionization of the background gas. Compressions by a factor of two were observed. For layers whose self–well is the dominant focusing force, this compression agrees with adiabatic theory. A small ($\approx 20\%$) *E*–layer loss was observed during the compression. It is felt that this loss arises from scattering in electric field inhomogeneities. The effect of resistive walls on trapping efficiency was studied and it was shown that the efficiency scales with the theoretically calculated energy loss in the resistive walls. Finally, the results of the multiple pulse experiments are presented. Failure to achieve buildup of the *E* layer is attributed to a combination of losses during compression and poor trapping efficiency on later pulses. (auth)

Plasma Stability

Refer also to abstract 16303.

16245 (IPP–1/150) EQUILIBRIUM AND STABILITY INVESTIGATIONS IN THE BELT PINCH. Krause, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Sep 1974. 74p. Dep. NTIS (US Sales Only) $6.75.

Simple estimates show that tokamak confinement can be greatly improved by elongating the plasma cross section in the direction parallel to the torus axis, provided that the safety factor q does not have to be increased beyond the value required for circular cross sections. The equilibrium and stability of a plasma with elongated cross section was investigated in a toroidal belt pinch experiment. It was found that the initial plasma ($kT_e \approx$ 20 eV, $n_e \approx 10^{16}$ cm^{-3}) is not in equilibrium from the outset, but only attains it after ~25 μs as a result of contraction in the axial direction. Magnetic field measurements in the plasma showed that the axial contraction does not terminate until the initial radial compression ratio of ≈ 10 has dropped to ≈ 2, the axis ratio of the plasma cross section then being ~5. (auth)

16246 ROLE OF DISSIPATION DURING THE PROCESS OF NONLINEAR SATURATION OF EXPLOSIVE INSTABILITY. Kogan, E. Ya.; Oraevskii, V. N.; Pavlenko, V. P. (Inst. of Nuclear Research, Kiev). pp 285 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

It is shown that dissipative effects change the asymptotic behavior of amplitudes of interacting waves. The cyclotron wave interaction appearing in anisotropic plasma by strong nonequilibrium particle distribution is given as an example. For this case, the calculated matrix elements of interaction and nonlinear frequency shift determine the entire process of development of instability. (MOW)

16247 CORRELATION BETWEEN THE NATURE OF VELOCITY SPACE ANISTROPY AND THE FREQUENCY OF ELECTROSTATIC ELECTRON–CYCLOTRON INSTABILITIES. Jacquinot, J. (CEN, Fontenay-aux-Roses, France); Leloup, C.; Pellat, R.; Abdalla, M.; Chanteur, G. pp 287 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

It is shown that it is possible, in most cases, to infer qualitative information on the anisotropy of the distribution function by the simple knowledge of the frequency spectrum of the anomalous radiation emitted by the plasma. The characteristics of known-instabilities are first reviewed. An instability requiring a positive df/dE at low energy ("loss cone") and a small amount of cold plasma was studied. (MOW)

16248 STABILIZING EFFECT OF AN ELECTRON TEMPERATURE GRADIENT ON COLLISIONLESS DRIFT INSTABILITY. Brossier, P.; Deschamps, P.; Gravier, R.; Pellat, R.; Renaud, C. (CEN, Fontenay-aux-Roses, France). pp 311 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Drift instabilities which arise in low-beta, collisionless inhomogeneous plasmas are affected by the presence of an electron temperature gradient. Analysis of the dispersion relation shows that a gradient of the electron temperature component parallel to the confining field provides a stabilizing influence on the electronic drift instability if it points in the direction of the density gradient. An experimental study of this effect is described. (MOW)

16249 FREQUENCY ENTRAINMENT OF A DRIFT INSTABILITY BY NONLINEAR EFFECTS IN A PLASMA. Tavzes, R.; Cercek, M. (Univ., Ljubljana, Yugoslavia). pp 312 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Experimental results are presented which show that the drift instability can be described by the Van der Pol equation. The driving signal at the frequency ω, close to the instability frequency, was coupled to the plasma by the modulation of the microwave power which produced the plasma at ECR. (MOW)

16250 PLASMA INSTABILITY AND AZIMUTHAL CURRENTS. Kubarev, Y. V. (Moscow Inst. of Radio Engineering, Electronics, and Automation). pp 316 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Plasma fluctuations in varying magnetic fields were studied. In a positive column, fluctuations take place during rising current convective instability accompanied by helical plasma rotation. Diagrams showing magnetic field intensities in currents, and discharge pressure effects on plasma fluctuations are given. (MOW)

16251 PARAMETRIC DECAY INSTABILITY AT THE ION CYCLOTRON FREQUENCY INDUCED BY A LARGE AMPLITUDE ELECTRON BERNSTEIN WAVE IN A PLASMA. Keen, B. E.; Fletcher, W. H. W. (Culham Lab., Abingdon, Eng.). pp 328 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

It is seen that if a large amplitude electron Bernstein wave (ω_0) is incident on a plasma, above a certain incident power level another Bernstein wave (ω_1) at a lower frequency, plus a lf ion wave (ω_2) appears. These waves satisfy the conservation of energy relationship ($\omega_0 = \omega_1 + \omega_2$), and it seems plausible that they can satisfy the conservation of momentum relationship ($\bar{k}_0 = \bar{k}_1 + \bar{k}_2$). Further, it was found that the threshold electric field value agreed reasonably well with a previous theory on parametric decay processes. Therefore, it is concluded that the observed instability is the decay instability at the ion cyclotron frequency induced by a large amplitude electron Bernstein wave. (MOW)

16252 PARAMETRIC WAVE EXCITATION IN PLASMA IN SPACE-PERIODIC HIGH FREQUENCY FIELD. Pasechnik, L. L.; Semenyuk, V. F. (Nuclear Research Inst., Kiev). pp 331 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The experiments were conducted in a weakly ionized helium plasma. Plasma parameters and space-time characteristics of the exciting waves were studied with probes and dipole antennas. Oscillograms showing the high frequency field amplitude are given. (MOW)

16253 THRESHOLD FIELD FOR PURELY GROWING INSTABILITY OF A WARM PLASMA COLUMN. Zhelyazkov, I.; Nenovski, P. (Univ., Sofia). pp 334 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

One of the mechanisms for the anomalous absorption of electromagnetic waves is the so-called purely growing instability and it has been studied in detail for the case of infinite plasmas. The threshold condition for such an instability in a real plasma geometry is derived. (MOW)

16254 SIDEBAND GROWTH AND MACROSCOPIC FOUR WAVE INTERACTION. Brinca, A. L. (Stanford Univ., CA). pp 341 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Recent independent computer and laboratory experiments with electron plasma waves of large amplitude have disclosed a new sideband instability which seems to be unrelated to particle trapping, and is clearly distinct from the sideband instability first observed by Wharton, et al. In the initial value problem studied in the computer experiment, the Maxwellian plasma with fixed ions is excited by a main mode of wave number k_1 with amplitude below the threshold required to observe the trapped-particle sideband instability. When a second wave of wave number k_2, $|k_1 - k_2| \ll k_1$, is applied, one observes rapid growth of the electrostatic mode with wave number $k_3 = 2k_1 - k_2$. Typical values in the numerical experiment are given. (MOW)

16255 ENHANCEMENT OF MODIFIED TWO-STREAM INSTABILITY BY rf ELECTRIC FIELD. Takamura, S.; Okuda, T. (Nagoya Univ., Japan). pp 361 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The modified two-stream instability, which is excited by the relative drift motion between the ion and the electron perpendicular to the static magnetic field, was studied in relation to ion heating. Although this mechanism is proposed to explain some experiments of the turbulent heating, it may be difficult or complicated to produce the transverse current, which may be shortcoming in the experiments of the modified two-stream instability. The enhancement of this instability by the application of the auxiliary rf electric field to the current carrying plasma is shown. In contrast with the present case the stabilization of the ion wave instability was also examined experimentally and theoretically. (MOW)

16256 PARTIAL STABILIZATION OF BEAM–PLASMA INSTABILITY BY AXIAL PLASMA INHOMOGENEITY. Demchenko, V. V.; Hussein, A. M.; Zayed, K. E. (Atomic Energy Authority, Cairo). pp 393 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The main features to which the plasma axial inhomogeneity leads are demonstrated by an example of the excitation of slow surface waves by a homogeneous monoenergetic beam at the boundary of a half-bounded isotropic plasma. It is shown that the growth rate of unstable oscillations in inhomogeneous plasma decreases in comparison with that in a homogeneous one. (MOW)

16257 RELAXATION OF TWO-STREAMING ION MOTION IN PLASMA IN WEAK TRANSVERSE MAGNETIC FIELD. Borisenko, A. G.; Kirichenko, G. S. (Nuclear Research Inst., Kiev). pp 394 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

This instability was investigated experimentally upon ion beam injection into a plasma perpendicular to the magnetic field. The relaxation in plasma of two ion beams of equal density moving in the same direction with different rates transversely to the weak magnetic field was studied. (MOW)

16258 TWO-DIMENSIONAL CALCULATION OF TOKAMAK STABILITY. Sykes, A.; Wesson, J. A. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Nucl. Fusion; 14: No. 5, 645-648(Nov 1974).

A numerical procedure for determining the hydromagnetic stability of axisymmetric systems is described. The growth rates and eigenfunctions are determined by means of a modified initial value method. A number of tokamak configurations were studied and stability boundaries and growth rates are given. With a conducting wall on the plasma the fundamental toroidal mode is stable and the $m = 1$ mode is stable for $q \gtrsim 1/2$. (auth)

16259 INFLUENCE OF NONLINEAR FREQUENCY SHIFTS AND EFFECTIVE NONLINEAR DISSIPATION ON EXPLOSIVE INSTABILITIES. Weiland, J. (Chalmers Tekniska Hoegskola, Goteborg). Phys. Scr.; 9: No. 6, 343-349(Jun 1974).

The effects of nonlinear frequency shifts and effective nonlinear dissipation on explosive instabilities in the coherent-phase description are studied in the case where the complex second order coupling factors have mutually different phase angles. Linear dissipation is also considered. It is shown that nonlinear frequency shifts alone cannot stabilize all amplitudes, although they may change the explosive type of instability into an exponential one. (auth)

16260 MHD INSTABILITIES AS AN INITIAL BOUNDARY-VALUE PROBLEM. Bateman, G.; Schneider, W.; Grossmann, W. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). Nucl. Fusion; 14: No. 5, 669-683(Nov 1974).

The gross MHD instabilities of straight cylindrical plasmas with elongated cross section are investigated by solving the linearized MHD equations as an initial boundary-value problem on the computer. The linearized equations are Fourier-analyzed along the ignorable co-ordinate of the equilibrium in order to reduce the computation to two dimensions. The method is applied to find the fixed-boundary instabilities of an equilibrium with rectangular walls. Starting with an arbitrary initial perturbation and following it for many Alfvén transit times, one finds that the dominant instability overwhelms all stable oscillations after several e-folding times. The growth rates are determined for the fastest growing instabilities as a function of the equilibrium parameters. The spatial structure of the physical variables ($\vec{v}^1$, $\vec{B}^1$, p^1) is examined. One finds that the cross section of the velocity field displays a distinctive convection pattern. This structure becomes spatially concentrated around the point of maximum rotational transform as the equilibrium current is decreased to the marginal point, and concentrates near the wall as the current is increased. Given the equilibrium $p'(\psi) = J_{pc}\,\psi/\psi_c$, ψ (wall) = 0, one finds that the marginal current density J_{pc} for each mode increases as the cross section is elongated. But the growth rates of the higher azimuthal m-modes increase with elongation and their intervals of instability overlap with the lower m-modes. (auth)

16261 NEOCLASSICAL DIFFUSION IN A HELICALLY PERTURBED MAGNETIC FIELD. Krommes, J. A.; Rutherford, P. H. (Princeton Univ., NJ). Nucl. Fusion; 14: No. 5, 695-702(Nov 1974).

Neoclassical particle diffusion and heat transport are discussed for tokamak-like devices in the "banana" regime ($\nu_{eff} < \omega_b$) with helically perturbed magnetic fields such as might be produced by kink-like instabilities. The diffusion coefficient scales as $D \sim (\nu_1/\nu)\,\xi^2 D_{pl}$ where ξ is related to the amplitude of the perturbation and ν is the collision frequency. For typical experimental parameters and sufficiently low collision frequency, transport is moderately enhanced over the axisymmetric result. (auth)

16262 STABILIZATION OF THE DISSIPATIVE TRAPPED-ION INSTABILITY BY IMPURITIES. Dobrowolny, M. (Univ., Aquila, Italy). Nucl. Fusion; 14: No. 5, 599-609(Nov 1974).

The influence of impurities on the dissipative trapped-ion instability is investigated considering all possible cases of ion impurities in the banana, plateau or Pfirsch–Schlüter regimes. It is found that impurities lead to very significant stabilizing effects on these modes. In particular, the instability is quenched when the impurities are in the Pfirsch-Schlüter regime, and also for plateau impurities, provided the impurity density gradients are directed as the main plasma density gradient. In the case of impurities in the banana regime, a sufficient condition for complete stabilization of the instability was found in the case of sufficiently sharp and positive impurity gradients. In the unstable cases, there is a noticeable upward shift and shrinking of the unstable range increasing with impurity concentration. These features were discussed quantitatively, in terms of impurity parameters, both with reference to present-day experiments and for future experiments with reduced impurity levels. (auth)

16263 ABSOLUTE INSTABILITY THRESHOLDS FOR PARAMETRIC–DECAY INTERACTIONS IN PLASMAS. Cassedy, E.S. (Polytechnic Institute of New York, Brooklyn, New York 11201); Mulser, P. Phys. Rev. A 10: No. 6, 2349-2359 (Dec 1974).

An analytical expression for the threshold of absolute growth for a parametric–decay instability is given for the simplest three–frequency interaction in a homogeneous plasma. The validity of this expression as compared to the results of a four–frequency interaction (including the upshifted frequency) at densities near critical is investigated using saddle–point mapping criteria. The investigation is carried out using pump intensities sufficiently large so that the effects of the oscillating–two–stream interaction should be manifest in the dispersion mapping for the parametric decay interaction. It is found that the absolute decay instability is preserved through a regime of parameters corresponding to intensities of 10^{14} W/cm^2 and a critical parameter of $\omega_{pe}/\omega_0 = 0.999$. No parametric–decay instability is found for an overdense plasma. Finally, for a typical laser plasma, minimum threshold intensities are shown to exist for absolute instability of the parametric decay interaction at subcritical densities which are closer to the critical density than the previously known minimum thresholds for convective growth. (auth)

16264 EQUILIBRIUM OF A TOROIDAL PLASMA. Sudano, J.P. (Instituto Tecnológico de Aeronáutica, São José dos Campos, Est. São Paulo, Brasil). Phys. Fluids 17: No. 10, 1915-1916 (Oct 1974).

A class of exact magnetohydrodynamic toroidal equilibrium solutions is found, which holds good for arbitrary aspect ratio. (auth)

16265 MAGNETOHYDRODYNAMIC EQUILIBRIA FOR A BUMPY AXISYMMETRIC PLASMA COLUMN. Golovato, S.N.; Shohet, J.L. (The University of Wisconsin, Madison, Wisconsin 53706); Tataronis, J.A. Phys. Fluids 17: No. 10, 1860-1864 (Oct 1974).

Solutions to the nonlinear ideal magnetohydrodynamic equilibrium equations are numerically computed for the case of an infinitely long axisymmetric plasma column. Boundary conditions are imposed which force the axial variation of the configuration to be sinusoidal thus giving rise to "bumpy" flux surfaces. Current is allowed in both the axial direction and in the direction of the ignorable coordinate. It is found that the depth of penetration into the plasma of the bumpiness increases when the axial current or the plasma β is increased. The effect of the presence of a perfectly conducting wall of constant radius together with a limiter of variable radius on the equilibria is also investigated. Applications to present and proposed tokamak experiments are made. (auth)

16266 SUFFICIENT STABILITY CRITERIA FOR PLASMA EQUILIBRIA WITH TENSOR PRESSURE. Spies, G.O. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012); Nelson, D.B. Phys. Fluids 17: No. 10, 1865-1878 (Oct 1974).

Sufficient stability criteria are derived which are valid in various situations for which an energy principle holds, i.e., tensor or scalar pressure, collisionless or collisional dynamics, toroidal or open–ended geometry, conducting or insulating walls, closed or ergodic magnetic field lines. These criteria reduce to well known ones in toroidal equilibria with scalar pressure. They are close to necessary criteria in low beta equilibria allowing for interchanges. Various well known favorable properties (viz., good curvature, magnetic well, negative v'', linetying) are recovered by considering special classes of equilibria. Since, in general, none of these properties appears to be crucial, the present criteria are capable of yielding a variety of hitherto unknown stably confined equilibria. (auth)

16267 PROPERTIES OF MAGNETICALLY CONFINED PLASMA EQUILIBRIA. Spies, G.O. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012); Nelson, D.B. Phys. Fluids 17: No. 10, 1879-1884 (Oct 1974).

Certain well known properties of toroidal magnetohydrostatic equilibria with scalar pressure are shown to carry over to a class of equilibria with tensor pressure including open–ended equilibria with free ends. This class is characterized by the existence of a particular family of surfaces which, because of their analogy to the pressure surfaces of equilibria with scalar pressure, are called "generalized pressure surfaces." (auth)

16268 EFFECT OF THE TEMPERATURE GRADIENT ON THE ORDINARY MODE ELECTROMAGNETIC INSTABILITY IN A HIGH–BETA PLASMA. Nambu, M. (Department of Physics, The Premedical Section, Kyorin University, School of Medicine, Miyashita–cho, Hachioji–shi, Tokyo, 192, Japan). Phys. Fluids 17: No. 10, 1885-1888 (Oct 1974).

The effect of nonuniformities of temperature, magnetic field, and number density on the ordinary mode with temperature anisotropy is investigated. It is shown that in a high–β plasma the new and much stronger instability due to electron wave resonance with temperature gradient and temperature anisotropy occurs. The ordinary mode instability in an inhomogeneous plasma is possible under the condition $T_{\perp e}$ (electron perpendicular temperature) $> T_{\| e}$ (electron parallel temperature), in contrast to the previous results $T_{\| e} > T_{\perp e}$. The pitch angle diffusion of particles is also investigated. (auth)

16269 ELECTRIC FIELD DRIVEN FLUTE INSTABILITIES IN A NONUNIFORM COLLISIONAL PLASMA. D'Ippolito, D.A. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Krall, N.A. Phys. Fluids 17: No. 10, 1848-1852 (Oct 1974).

The stability of a magnetically confined nonuniform plasma column with a radial electric field is examined with a linear single–fluid theory including the effects of rotation, ion–neutral collisions and finite Larmor radius stabilization. The transition from the Rayleigh–Taylor instability in the collisionless limit to the Simon neutral–drag instability in the collision–dominated limit, and the effect of collisions on finite Larmor radius stabilization, is studied in detail. A numerical example is given and the application of the theory to experiments is discussed. (auth)

16270 TURBULENCE IN A CUSP Q DEVICE. D'Angelo, N. (Danish Atomic Energy Commission, Research Establishment Risø, Roskilde, Denmark); Pécseli, H.L.; Petersen, P.I. Phys. Fluids 17: No. 10, 1853-1856 (Oct 1974).

Spectral measurements are reported of plasma turbulence in the Cs plasma of a Q device, modified to a magnetic cusp geometry. The excitation mechanism for the fluctuations appears to be the centrifugal instability discussed by Chen. A transition from an f^{-5} to an f^{-3} power spectrum is observed as one moves from the hot plates to the midplane of the cusp. (auth)

16271 LAUNCHING AND PROPAGATION OF REGULAR NONLINEAR WAVES IN AN ANISOTROPIC PLASMA–FILLED WAVEGUIDE. Kurilko, V.I.; Tols–toluzhskii, A.P.; Fainberg, Ya.B. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Tech. Phys. 19: No. 5, 622-627 (Nov 1974).

Hydrodynamic theory is derived for the launching and propagation of regular periodic waves of finite amplitude propagating along the axis of a cylindrical plasma–filled waveguide in a strong external magnetic field. It is shown that the problem of seeking the field configuration dispersion of such waves reduces to the solution of a quasilinear equation of the elliptic type for the high–frequency potential. The slightly nonlinear solutions of this equation are classified. The conditions under which periodic waves of finite amplitude exist are determined. Analytic expressions are found for the dispersion and wave configuration at Mach numbers near unity. The Cerenkov excitation of a nonlinear plasma–filled waveguide by a train of charged disks is analyzed. The plasma nonlinearity stabilizes the Budker and Cerenkov instabilities of a relativistic beam injected into a bounded plasma. (auth)

16272 CERENKOV INSTABILITIES OF A RELATIVISTIC BEAM IN A PERIODIC PLASMA–FILLED WAVEGUIDE. Kurilko, V.I.; Tkach, Yu.V.; Shendrik, V.A. Sov. Phys.–Tech. Phys. 19: No. 5, 607-611 (Nov 1974).

A hydrodynamic theory is derived for the Cerenkov instability of a monoenergetic, relativistic electron beam in a periodic plasma–filled waveguide. The frequencies and growth rates are found for the limiting cases of strong and weak magnetic fields. Under certain conditions the presence of a plasma can strongly influence the interaction of the beam with a periodic waveguide. (auth)

16273 INSTABILITIES IN A FINITE–β PLASMA WITH TRANSVERSE CURRENT. I. Pyatak, A.I.; Sizonenko, V.L. Sov. Phys.—Tech. Phys. 19: No. 5, 635-639 (Nov 1974).

We consider a plasma with current that flows at right angles to the confining magnetic field; the high–frequency small–scale instabilities that propagate with a phase velocity along the magnetic field that is appreciably lower than the electron thermal velocity are analyzed. Allowance is made for inhomogeneity of the magnetic field. The instabilities are electromagnetic; frequencies and growth rates are determined. (auth)

16274 PARAMETRIC INSTABILITY OF PLASMA IN A WEAK ALTERNATING ELECTRIC FIELD UNDER LOWER HYBRID RESONANCE CONDITIONS. Kitsenko, A. B.; Panchenko, V. I.; Stepanov, K. N. (Physical-Technical Inst., Kharkov). Plasma Phys.; 16: No. 12, 1109-1120(Dec 1974).

Parametric excitation of longitudinal oscillations of plasma was studied in a weak alternating electric field with frequency ω_0 close to that of electron-ion hydrodynamic longitudinal oscillations of "cold" plasma, $\omega_1 = \omega_{LH}[1 + (m_i/m_e)\cos^2\theta]^{1/2}$, where ω_{LH} is the lower hybrid resonance frequency. The angle θ between the direction of propagation of the oscillations and the magnetic field is close to $\kappa/2$. It is shown that oscillations are excited in the plasma with frequencies $\omega \ll \omega_0$ if the drift velocity of the particles in the steady external magnetic field and the alternating electric field is less than the thermal velocity of the ions. Excitation of electron-acoustic, ion-cyclotron, and ion-acoustic waves are considered. Conditions are defined for which the oscillations become unstable, and estimates are given for the maximum growth rates of the oscillations. (auth)

16275 MAGNETODRIFT WAVES IN A FINITE –β PLASMA Ryzhov, N.M.; Sizonenko, V.L.; Suprunenko, V.A.; Sukhomlin, E.A.; Gutarev, Yu.V. Sov. Phys.–Tech. Phys. 19: No. 6, 722-725 (Dec 1974).

The low–frequency magnetodrift instability is studied in the finite–β plasma of an electrodeless induction discharge (a theta pinch). The instability is of a kinetic nature ($\omega < k_z v_{Te}$) and results from a mechanism that thermalizes the electrons accelerated by the induction electric field. The peak magnetic field of the waves is comparable to the main magnetic field. (auth)

16276 BEHAVIOR OF THE SIDEBAND INSTABILITY. Van Hoven, G.; Jahns, G. (Physics Department, University of California, Irvine, California 92664). Phys. Fluids 18: No. 1, 80-88 (Jan 1975).

The mechanism of the trapped–electron instability of a large–amplitude wave is revealed by the following experimental observations: Sideband waves exhibit an initial enhanced damping (examined by the use of linear test excitations) for a distance $\sim\lambda_{tr}$ the large–wave oscillation length. Beyond this point, the unstable waves grow with a rate linearly proportional to the main–wave electric potential. Measurements show that the instability growth depends on the initial amplitude of the large wave and can persist after this wave field has decayed by tens of decibels. This implication that the driving force of the instability resides in the particles is substantiated by direct measurements of the electron distribution function which, in the presence of a large wave, is found to develop a "bump–on–the–tail" of sufficient magnitude to account for the observed sideband growth. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstracts 16142 and 16161.

16277 (BNL-19344) NUCLEAR DATA FOR CTR RELATED PROJECTS. Bhat, M. R.; Magurno, B. A.; Pearlstein, S.; Scheffel, F. M. (Brookhaven National Lab., Upton, N. Y. (USA)). Oct 1974. Contract AT(30-1)-16. 59p. (ENDF-212). Dep. NTIS $6.00.

The different types of nuclear cross section information that have been supplied to CTR-related projects and are available at the National Neutron Cross Section Center are described. This has included data from the ENDF/B and ENDF/A libraries as well as the results of calculations based on nuclear systematics. (auth)

16278 (HEDL-TME-74-64) CTR QUARTERLY REPORT, JULY–SEPTEMBER 1974. Doran, D. G.; Schiffgens, J. O.; Simons, R. L.; Yoshikawa, H. H.; Odette, G. R. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-2170. 24p. Dep. NTIS $4.00.

This initial report on a new CTR program is concerned primarily with extending LMFBR program expertise on irradiation damage analysis to CTR materials and environments. The scope of the work includes damage function analysis, displacement cross section calculations, discrete modeling and continuum modeling. The program is intended to assist in the design of CTR materials irradiation testing programs, to correlate irradiation effects from various irradiation facilities, and to define the applicability of irradiation test data from other programs to the CTR effort. (auth)

16279 (IPP–4/119) MHD PRESSURE LOSSES AS A POSSIBLE CRITERION FOR THE SELECTION OF STRUCTURE MATERIALS FOR FUSION REACTOR BLANKETS. Daenner, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Aug 1974. 17p. (CONF-740468–2). Dep. NTIS (US Sales Only) $4.00.

From reactor conference; Berlin, F. R. Germany (2 Apr 1974).

In the present stage of fusion reactor development no decision can be made concerning the optimum structure material to be used in the blanket region. A comparison is given of four candidate materials in view of the effects caused by MHD pressure losses. The differences in the material properties, especially the electrical and mechanical properties, thereby lead to a different choice dependent on the coolant temperature range and on the criterion used. The investigation shows that all materials considered, i.e., stainless steel, vanadium, niobium, and molybdenum, have chances if the absolute pressure drop is the quantity of interest. Only vanadium and molybdenum remain in consideration if the amount of material is essential. If the costs will be the determining quantity it seems possible that the selection will only yield stainless steel and molybdenum as the most advantageous materials. (auth)

16280 STUDY OF A COMPLEX PLASMA INJECTOR. Zavada, P. I. (Physico-Technical Inst., Kharkov); Kalmykov, A. A.; Tereshin, V. I.; Chebotarev, V. V.; Yakubovskii, V. G.; Skladnik-Sadowskaja, E. Nucl. Fusion; 14: No. 5, 727-729(Nov 1974).

A complex plasma injection device was investigated. It consists of a coaxial plasma accelerator with gas preionization and a spatially periodic sign-changing magnetic field used to guide the high-velocity plasma stream and to separate the slow one. A high-energy plasma stream with a total energy of ≥ 160 J (4 to 4.5×10^{17} particles) and an amount of impurities not exceeding 1% was obtained at the output of the magnetic system. It is seen that the guiding magnetic field does not penetrate into the leading fast plasma puff, which implies that the connection of the injector system to the magnetic traps should be simplified when a complex plasma injector of such type is used. (auth)

16281 SERVO-CONTROL OF PLASMA POSITION IN CLEO-TOKAMAK. Hugill, J.; Gibson, A. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Nucl. Fusion; 14: No. 5, 611-619(Nov 1974).

A system for servo-control of the plasma position in a tokamak discharge is described. Measurements of the stability boundary of the servo-loop in the Cleo-Tokamak apparatus are presented and compared with a theoretical model. They show reasonable agreement. Using servo-control, the discharge time was extended from 110 ms to nearly 200 ms, and the plasma remained within ±10 mm of the center of the vacuum vessel for up to 140 ms. The instability caused by a deliberately applied vertical field with positive gradient was stabilized. (auth)

16282 EFFICIENCY OF INJECTION OF NEUTRAL BEAMS INTO THERMONUCLEAR REACTIONS. Hovingh, J.; Moir, R. W. (Univ. of California, Livermore). Nucl. Fusion; 14: No. 5, 629-637(Nov 1974).

The overall efficiency of a thermonuclear reactor depends markedly on the efficiency of neutral-beam injection. The model of the injector system is based on direct conversion of the un-neutralized portions of the ion beam. The injection efficiency is estimated from assumptions on the performances of the components of the injection system. Based on this model, deuterium or tritium atoms derived from negative ions and between 100 keV and 1000 keV in energy can be injected into the reactor with an efficiency of 80 to 90%. Without direct conversion this efficiency will drop to 65 to 85%. For energies around 100 keV, D^+ ions can be used to obtain a system efficiency of about 75%, which is higher than can be obtained with D_2^+ or D_3^+ ions. The same model predicts 80% efficiency below 200 keV for injection of ^3He atoms derived from positive ions, and less than 70% efficiency between 200 keV and 700 keV using $^3H^-$ ions. (auth)

16283 IMPURITY TRANSPORT IN TOKAMAKS IN THE BANANA-PLATEAU REGIME. Hinton, F. L.; Moore, T. B. (Univ. of Texas, Austin). Nucl. Fusion; 14: No. 5, 639-644(Nov 1974).

Transport coefficients, relating ion and impurity fluxes, and their fluxes of energy, to the density and temperature gradients, are derived from neoclassical theory. The ions are assumed to have mean free paths much longer than the torus connection length. The banana-plateau transition is shown to depend upon additional parameters which are not present in the electron-ion problem. Only two different ion masses are considered, but the heavier ions may have an arbitrary number of different possible ionization states. The mass ratio is arbitrary; the small mass-ratio limit is considered in detail, however. In that limit, the critical value of the collisionality parameter ν_{i*}, for the transition from banana regime to plateau regime for the fluxes due to ion-impurity collisions, is shown to be $\sim(n_I/n_i)(m_I/m_i)^{1/2}$, where i denotes light ions and I denotes impurities. The plateau regime values of the corresponding transport coefficients are proportional to this parameter, which may be much smaller than unity, in typical cases. The modification of electron transport properties due to impurities is also discussed. (auth)

16284 IMPOSSIBILITY OF SHIELDING AGAINST THE RF RADIATION OF A THERMONUCLEAR REACTOR WITH A COLD–PLASMA SHEATH. Chikhachev, A.S. (Moscow Engineering–Physics Institute). Sov. Phys.–Tech. Phys. 19: No. 5, 685-685 (Nov 1974).

The problem of shielding the first wall of a thermonuclear reactor against the highest–frequency part of the radiation of a thermonuclear plasma is analyzed. It is shown that this shielding cannot be achieved with a sheath of cooler plasma because the absorption coefficient α_ω is not a function of the temperature at frequencies $\omega > T_e/\hbar$, where ω is the frequency of the radiation and T_e is the temperature of the cooler plasma. (auth)

Wave Phenomena

Refer also to abstract 16271.

16285 (JINR–P11-8261) MATHEMATICAL SIMULATION OF THE WEAK LANGMUIR TURBULENCE DYNAMICS. Bobyleva, L. V.; Getmanov, B. S.; Zhidkov, E. P.; Makhan'kov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The evolution in time of different anisotropic packets of Langmuir waves due to their induced scattering on plasma ions is considered. The problem of an isotropization of the weak Langmuir turbulence is investigated for various initial data. It turns out that the process of isotropization of oscillations may be of essentially longer duration than that of the energy transfer along the spectrum. (auth)

16286 LAGRANGIAN APPROACH TO WAVE–PARTICLE INTERACTIONS. Turner, J. G. (Polytechnic of Central London). pp 282 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

An outline is given as to how the Lagrangian formulation can be used to derive the quasilinear equations describing the interaction between electrons and plasma oscillations in an electron plasma. A quantum mechanical treatment is used. A qualitative account of the theory is given and quasi-linear equations are derived. (MOW)

16287 ELECTROSTATIC WAVES EQUATION IN AN INHOMOGENEOUS HOT MAGNETIZED PLASMA. Pelletier, G. (Universite Scientifique et Medical, Grenoble, France). pp 283 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The linearized Vlasov equation was solved using a one parameter group of transformations of phase space associated with Vlasov's stationary field. The continuous linear functional nature of the distribution was taken into account. This means that the distribution is the linear form which associates to a microscopic quantity the corresponding macroscopy quantity. (MOW)

16288 DISSIPATIVE PROPERTIES OF LINEARIZED VLASOV–MAXWELL EQUATIONS AND LANDAU'S DAMPING. Turski, A. J. pp 284 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

It is shown that the linearization of nonlinear Vlasov–Maxwell equations can introduce dissipativity to an energy conservative system. The linearization around a Maxwell equilibrium distribution of longitudinal oscillations leads to energy dissipation and Landau damping whereas the linearization around the Lorentz equilibrium distribution does not. The properties of time reversibility, evolution, and space reflection of the nonlinear system are preserved after linearization. (MOW)

16289 CONNECTION BETWEEN THE CONTINUUM EIGENFUNCTIONS AND THE DISPERSION FUNCTION OF THE VLASOV OPERATOR. Sedlacek, Z. (Inst. of Plasma Physics, Prague). pp 286 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

It was shown earlier (Sedlacek Z. Czech. J. Phys. B18 (1968), 618) that the continuum eigenfunction of the Vlasov operator is in a certain way related to the boundary values of the dispersion function on the real axis of the complex frequency plane. This relationship and its possible practical consequences are discussed. (MOW)

16290 DENSITY GRADIENT DRIFT WAVES AND ANOMALOUS RESISTIVITY. D'Ambrogio, E. D.; Nocentini, A. (Universita degli Studi, Trieste, Italy). pp 310 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The anomalous resistivity due to collisionless drift waves driven by the density gradient in a low-β plasma was studied. This problem is different from that one on ion acoustic waves, the resistivity being due not to a turbulence created by the current, but to a modification, due to the current, of the spectrum of the waves already existing in the plasma. A quasi linear theory is used and the problem in plane geometry is treated. A two species low-β plasma embedded in a constant and uniform magnetic field B, pointing in the z direction is considered. Charge neutrality and thermal equilibrium, with a weak x-dependence of the number density N(x) is assumed. A plasma of this kind is microscopically unstable and drift waves develop. (MOW)

16291 FAST LONGITUDINAL RESISTIVE DRIFT WAVES IN A WEAKLY IONIZED PLASMA. Milic, B. (Inst. of Physics, Belgrade). pp 313 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A systematic investigation was made of the drift modes with the purpose of analyzing the role of electron collisions. A method based on the geometrical optics approximation and on the evaluation of the pertinent eikonal on the ground of the kinetic energy formalism was used. The plasma was assumed to be weakly ionized and was described by Boltzmann collision integrals. (MOW)

16292 OSCILLATIONS OF DRIFT-DISSIPATION NATURE IN WEAKLY IONIZED PLASMA. Shvilkin, B. N.; Postnikov, S. A.; Skovoroda, A. A. (Moscow State Univ.). pp 314 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Drift oscillations, the frequency of which is lower than ion cyclotron and ion acoustic frequencies, belong to the above oscillations. Both types of oscillations are present in weakly ionized currentless plasma at low pressures. Their frequency is higher than the average frequency of collisions of ions with neutral atoms. Data are presented and discussed. (MOW)

16293 VELOCITY OF SOUND FOR A NON-EQUILIBRIUM PLASMA. Kelm, S. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt eV, Stuttgart). pp 317 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The velocity of sound is derived for the general case of a non-LTE plasma (or PLTE-plasma) from the continuity equation, momentum equation and energy equation (LTE: local thermodynamic equilibrium, PLTE: partial local thermodynamic equilibrium). (MOW)

16294 INFLUENCE OF ION-SOUND OSCILLATIONS ON PLASMA PARAMETERS. Kuzovnikov, A. A.; Swiridkina, V. S.; Tarasova, V. V. (Moscow State Univ.). pp 318 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

An investigation was made of hf field influence on plasma parameters, in particular, on time-independent distribution of charged particle concentration in plasma. (MOW)

16295 EXCITATION OF TURBULENCE BY MAGNETO-ACOUSTIC WAVES. Ag, A.; Finken, K. H.; Laeuter, R.; Stampa, A.; Tuczek, H. (Kernforschungsanlage, Juelich, Ger.). pp 320 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Magnetoacoustic waves propagating in the radial direction of a magnetized plasma column are excited by a traveling electromagnetic wave. The calculated and measured energy transfer from the wave to the plasma are shown. The peaks of maximum energy transfer at the theoretical curve correspond to the first and second order eigenmode of the system. The enhancement of the field is described. (MOW)

16296 AMPLITUDE MODULATION OF ION ACOUSTIC WAVES BY SUPERPOSITION WITH ELECTRON FREE STREAMING WAVES. Behnke, J.; Kagel, H.; Leven, R. (Univ., Greifswald, Ger.). pp 321 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Amplitude oscillations of large-amplitude waves were found earlier. The distance between the amplitude maxima becomes shorter by increasing the exciting voltage and is several times longer than the wavelength. The mechanism of the amplitude oscillations is understood as the alternate exchange of energy between wave and the resonant particles trapped in the wave potential. In these ion acoustic wave experiments, a coincidence of the modulation length with the wavelength of ion acoustic waves was observed that seems to be independent of the exciting voltage. This fact is illustrated. (MOW)

16297 PROPAGATION OF ION ACOUSTIC WAVES AT FREQUENCIES APPROACHING THE ION PLASMA FREQUENCY. Aubert, A. E.; Van Dael, W. (Katholieke Universiteit td Leuven, Heverlee, Belg.). pp 322 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Ion acoustic waves have been widely studied especially for frequencies around the plasma ion frequency f_{pi} and some controversial results have been reported, i.e., increase in velocity and propagation beyond f_{pi} or decrease in velocity and cutoff before f_{pi} is reached. The propagation of ion acoustic waves in a low density argon plasma for frequencies up to 0.84 from f_{pi}. The experimental results are compared with the predictions of a fluid model. (MOW)

16298 ION-SOUND INSTABILITY EFFECT ON PLASMA HEAT CONDUCTIVITY. Mishin, E. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). pp 324 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Ion acoustic instability is known to be excited in plasma with inhomogeneous temperature. The transport coefficients of that plasma greatly differ from classical ones. Plasma thermal conductivity coefficients in the presence of intensive ion oscillations were calculated. (MOW)

16299 PARAMETRIC EXCITATION OF WAVES IN MAGNETIZED PLASMA. Andreev, N. E.; Batanov, G. M.; Sarksyan, K. A. (Lebedev Inst. of Physics, Moscow). pp 327 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The understanding of the nonlinear processes in magnetized plasmas in the presence of ultrahigh frequency electromagnetic fields is of importance because of anomalous microwave absorption, anomalous heating of electrons and nonthermal radiation at the satellite frequencies. These anomalous phenomena are connected with excitation of parametric instabilities, the development of which causes turbulence in the plasma. Intensity estimations are given of waves that are parametrically driven by UHF pumping waves in a magnetized collisionless plasma. Experimental results on the nonlinear saturation of plasma wave amplitude are given. (MOW)

16300 MEASUREMENT OF Q VALUE IN THE PRESENCE OF AN ION SOUND WAVE PARAMETRICALLY EXCITED IN TONKS-DATTNER RESONANCE. Ikezawa, S. (Chubu Inst. of Tech., Aichi, Japan); Okuda, T. pp 330 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

This experiment is characterized by the following: (1) low frequency oscillation responsible for anomalous resistivity is an ion acoustic wave parametrically excited in Tonks–Dattner resonance and (2) the mode for measuring the Q value, which is a first Tonks–Dattner mode, is different from the mode exciting the low frequency oscillation. The field pattern of the measuring mode should be so chosen that the field exists mainly in the region where the low frequency oscillation is excited. The first Tonks–Dattner mode is more suitable for the measuring mode than the main mode, in which the field is concentrated at the surface of plasma column. (MOW)

16301 ANALYSIS OF THE BACKSCATTER SPECTRUM FROM A PLASMA SUBJECTED TO A STRONG RF SIGNAL. Kim, H.; Harker, K. J.; Crawford, F. W. (Stanford Univ., CA). pp 332 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

When a strong rf signal is the vicinity of the electron plasma frequency is applied to an inhomogeneous plasma, there is anomalously high absorption of energy and generation of additional frequencies. It is believed that this is due to parametric enhancement of plasma fluctuations by the pump wave. The effect has been observed in the laboratory, and in the ionosphere when the pump is an ordinary wave from a high-power transmitter (~kW). A convenient diagnostic technique to study the phenomena is by backscatter. A number of theories for the pump above threshold for parametric amplification have been advanced which explain certain of the features of the backscattered spectrum, e.g., fine structure. A theory is presented for the subthreshold case which explains both the fine structure of the plasma lines in the backscatter spectrum and the asymmetry of the up-shifted and downshifted components of these lines. The theory is developed in the context of the ionosphere for comparison with experiments. Similar considerations apply directly to laboratory plasmas. (auth)

16302 NUMERICAL STUDY OF THE HIGH AMPLITUDE LANGMUIR OSCILLATIONS. Sigov, Yu. S.; Khodirev, Yu. V. (Inst. of Applied Mathematics, Moscow). pp 333 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

One-dimensional computer simulation is used to investigate the time behavior of collisionless ion–electron plasmas disturbed by a standing wave of given amplitude with the wave number $k_0 \ll D_{e0}^{-1}$ (the initial electron Debye length). (MOW)

16303 HARMONIC AND SUBHARMONIC GENERATION OF ELECTROSTATIC WAVES IN COLLISIONLESS PLASMAS. Verheest, F.; Lewak, G. J. (Culham Lab., Abingdon, Eng.). pp 336 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The problem of harmonic and subharmonic generation of electrostatic waves in a general collisionless plasma is treated, using the coupled mode theory, and allowing as a possibility the presence of a negative energy wave. The plasma model is kept as general as possible, and only first principles such as energy conservation are invoked. The coupled mode equations obtained for the slow time variation of the amplitudes are then discussed in various limiting cases. When harmonic generation is possible in the case of two positive energy waves, an explosive instability occurs in the case of a positive and a negative energy wave. These conclusions seem independent of a particular model chosen to describe the plasma. A prerequisite, however, is that suitable decay conditions must be satisfied, and this should be much easier in a plasma than in other dielectrics. (MOW)

16304 GENERATION OF HARMONIC LANGMUIR WAVES DUE TO NONLINEAR LANDAU INTERACTION. Martinov, N. (Univ., Sofia). pp 337 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The generation and the amplification of harmonic nonlinear electron Langmuir waves are studied in a magnetoactive plasma, which interacts nonlinearly with a strong external oscillating electrostatic field. The theoretical investigation is based on the formalism that the external transversal field is homogeneous, while the parallel magnetic field is constant. (MOW)

16305 INSTABILITY OF THE HARMONICS OF AN ELECTROMAGNETIC WAVE BY MEANS OF A NON-LINEAR LANDAU INTERACTION. Samain, A. (CEA, Fontenay-aux-Roses, France); Martinov, N. (Univ., Sofia). pp 338 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Prospects are considered for the occurrence of an instability of the first and second harmonics of an electromagnetic wave interacting with an electronic collisionless plasma by means of a nonlinear Landau-type interaction. A number of conditions referring to the frequency of the amplitude of the external electromagnetic pump, the parameters of the plasma, and the magnitude of the external constant magnetic field have to be met for the generation of harmonic electromagnetic waves. (MOW)

16306 RESONANT AND NONRESONANT HARMONIC GENERATION. Smith, D. E.; Powers, E. J. (Univ. of Texas, Austin). pp 339 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Examples of resonant and nonresonant harmonic generation in the plasma are detailed. It is found that the resonant frequency selection rule is satisfied in both a dispersive and nondispersive media. Dispersion in the plasma is reflected, however, it is an inability of the interaction waves to satisfy the nonlinear resonant wavenumber selection rule. The spectral analysis technique utilized in this study is based upon digital computer processing of plasma data incorporating the fast Fourier transform (FFT) algorithm. (MOW)

16307 COMPUTER SIMULATION OF NONLINEAR PROCESS IN A TWO-WAVE SYSTEM. Matsuda, Y.; Crawford, F. W.; Self, S. A. (Stanford Univ., CA). pp 340 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A large amplitude monochromatic wave in a collisionless plasma undergoes amplitude oscillation and gives rise to sideband instability due to trapped particles. Observations are reported from computer simulation of a two-wave problem. An initial value problem is considered in which two electrostatic waves of arbitrary amplitudes are applied to a Maxwellian plasma at time t = 0. One of the interesting results is a strong four-wave coupling which cannot be explained by ordinary mode-coupling theory. (MOW)

16308 UNIDIRECTIONAL WAVE-ENERGY TRANSFER IN PLASMAS. Wang, P. K. C. (Univ. of California, Los Angeles). pp 342 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A fundamental aspect in the study of nonlinear wave–wave interactions in plasmas is the transfer of energy from one wave to another. The energy transfer into a particular wave is said to be unidirectional if this wave gains (loses) energy from (to) the remaining waves at all times. The unidirectional energy transfer in a system of three nonlinearly interacting waves is considered. The evolution of the complex amplitudes of these waves is described. (MOW)

16309 MODIFICATION OF LANDAU DAMPING BY COLLISIONAL EFFECTS. Froemling, G. (Ruhr-Universitaet, Bochum, Ger.). pp 343 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The effect is calculated for a small number of collisions on the dispersion law for the propagation of longitudinal waves in an unbounded homogeneous electron plasma in which infinitely massive ions scatter the electrons elastically. The usual Vlasov model is supplemented by two different collision terms to include effects linear in the parameter $\nu_c/k\alpha = (\omega_p/k\alpha) \ln \Lambda/\Lambda$ giving the magnitude of collisional effects. Λ denotes the plasma parameter, α the thermal velocity. (MOW)

16310 RESONANT WAVE–WAVE INTERACTION OF FINITE AMPLITUDE ELECTRON CYCLOTRON HARMONIC WAVES. Datlov, J. (Inst. of Plasma Physics, Prague); Klima, R.; Krysta, L.; Budnikov, V. N.; Scherbinin, O. N. pp 344 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

In the overdense plasma column the finite amplitude electron cyclotron harmonic waves (ECHW) were excited by means of extraordinary electromagnetic waves with the frequency f_1. In the range of $2 > \omega_1/\omega_{ce} > 1.5$ the relatively high power level of the second harmonic frequency $f_2 = 2f_1$ was measured. By means of a new simple graphical procedure it was found, that the second harmonic power is generated only if the conditions of resonant interaction of colinearly propagating ECHW of the type $\omega_2 = 2\omega_1$ $k_2 = \pm 2k_1$ are present inside the plasma column. (auth)

16311 NONLINEAR INTERACTION OF LONGITUDINAL OSCILLATIONS IN THE LOW-FREQUENCY HYBRID RESONANCE REGION IN INHOMOGENEOUS PLASMA. Demchenko, V. V.; El-Naggar, I. A. (Atomic Energy Authority, Cairo). pp 345 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

It is shown that the dependence of the nonlinear terms results in a nonlinear interaction of "longitudinal" and "transverse" oscillations of ions. Analytical expression for the amplitude of interacting oscillations were obtained from which it follows that the energy transformation process is of a reversible character, i.e., if at the initial moment of time the oscillation energy was concentrated in the transverse oscillations, then within a certain period of time this energy transforms into that of the longitudinal ones. (MOW)

16312 GEOMETRICAL RESONANCES ABOVE THE LOWER HYBRID MAGNETIC FIELD. Kraemer, M.; Schlueter, H. (Ruhr-Universitaet, Bochum, Ger.). pp 346 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The absorption of electromagnetic waves by a plasma column in the domain of the lower hybrid resonance due to geometrical effects can be much more important than the absorption at the intrinsic resonance $\omega = \omega_0$. The main condition for the existence of these geometrical resonances is $k_R \cdot R_p \approx 1$, i.e., the radial wavelength must be of the order of the plasma diameter. Furthermore, the wave number must be essentially real. In a cold plasma these conditions can only be fulfilled for values $\omega_0/\omega > 1$ and for sufficiently low collision frequencies ν_c. For the cases considered there is no basic change in the presence of sharp boundary conditions in the z-direction. (MOW)

16313 KINETIC THEORY OF THE INTERACTION OF AN ELECTROMAGNETIC WAVE WITH A PLASMA COLUMN. Storer, R. G. (Flinders Univ. of South Australia, Bedford Park). pp 347 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The interaction of an electromagnetic wave with a cylindrical plasma column is considered. The coupled Maxwell and Boltzmann equations are solved for a model studied previously in which the density is assumed to have a Gaussian form. This approximately represents the electron density in many experimental situations. For this inhomogeneous plasma it is shown that a kinetic theory analysis gives rise to a nonlocal form of Ohm's law which induces a coupling between the transverse and longitudinal waves in the plasma for angular modes with $m \geq 1$. This coupling does not appear in the cold plasma approximation. Two classes of resonances appear: when the frequency of the incoming wave, ω, is of the order of ω_p, the plasma frequency, a series of Tonks–Dattner or secondary resonances occur. In addition, size resonances occur when ω is of the order of $\omega_0 = c_0/a$, where $c_0 = \sqrt{2kT/m}$ is the mean thermal speed and a is the characteristic radius of the plasma. These latter resonances are particularly pronounced when the mean free path of the electrons is greater than the radius of the plasma and are due basically to the enhanced currents generated when the electrons traverse the plasma in step with the applied field. (MOW)

16314 MIXING OF ELECTROSTATIC WAVES IN A RADIALLY INHOMOGENEOUS HOT ELECTRON PLASMA. Gervais, F.; Guillemot, M.; Quemeneur, A. (CEN, Fontenay-aux-Roses, France). pp 348 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A hot plasma radially limited by a cylindrical waveguide of radius R and immersed in a strong magnetic field is considered. Propagation of electron Langmuir waves is the only consideration. Under such conditions, the plasma is relevant of the Vlasov–Poisson system. The distribution function and the potentials are developed. (MOW)

16315 HIGH-FREQUENCY SURFACE WAVES IN A SEMI-BOUNDED WARM CURRENT PLASMA. Shivarova, A. (Univ., Sofia). pp 349 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The dispersion relation, the damping rate, and the space damping (growth) rate of the high-frequency surface waves in warm homogeneous semibounded current plasma are studied. The region $x > 0$ is occupied by a warm homogeneous two-component plasma and the plane $x = 0$ is the boundary plasma-vacuum surface. The investigation is made for current plasma, i.e., the electrons and the ions drift in opposite directions with a velocity parallel to the boundary surface. The ion directed motion is neglected and it is assumed that the electrons drift with a velocity V, the electron component of the plasma is examined as a beam, penetrating through the background. The initial equations in the electrostatic approximation are the linearized Vlasov's and Poisson's equation with a boundary condition, i.e., perfectly reflecting wall (the plane $x = 0$). Assuming the current parallel to the interface one obtains the dispersion relation of the surface waves, propagating on the plasma-vacuum boundary. (MOW)

16316 MODE THEORY OF RECTANGULAR WAVEGUIDE CONTAINING LONGITUDINALLY MAGNETIZED UNIAXIAL COMPRESSIBLE MOVING PLASMA. Gupta, P. N.; Jain, P. K.; Singh, D.; Tolpadi, S. K. (Banaras Hindu Univ., India). pp 350 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The study of the propagation of electromagnetic waves through magnetized waveguides containing relativistically moving plasma has received in recent years attention by some authors. An attempt was made to understand the characteristics of a longitudinally magnetized rectangular waveguide containing uniaxial, compressible moving plasma by studying its dispersion relation. (MOW)

16317 LIMITATIONS IMPOSED BY WEAK LOW FREQUENCY FLUCTUATIONS IN NONLINEAR ELECTRON PLASMA WAVE EXPERIMENTS. Franklin, R. N. (Oxford Univ.); Smith, G. J.; Hamberger, S. M. pp 351 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

It is pointed out that low frequency, large scale-length, plasma density fluctuations lead to a broadening of the spectrum of the original wave which can, if care is not taken, be confused with nonlinear processes and may, in any case, prevent their unambiguous observation. Observations were made with electron waves propagating in low density, collisionless, thermally ionized sodium plasma column. Measured power spectra are shown when the initial amplitude of a lightly damped electron wave (ω_0, k_0) was varied in 10db steps $(\varphi_0 < 10$ mV) and the overall gain of the circuit was kept fixed. (MOW)

16318 EFFECT OF PLASMA INHOMOGENEITY ON THE DAMPING OF SLOW WHISTLERS. Kopecky, V. (Inst. of Plasma Physics, Prague). pp 352 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

In an inhomogeneous plasma, as a result of linear wave transformation, the conversion of one mode into another, with different wavelength and polarization, often occurs. Such conversion can result in a charge of the wave damping. This phenomenon also occurs for slow whistlers with the refraction index $N_z = k_z c/\omega > 1$ (k_z is the component of the wave vector in the direction of the magnetic field). It is known that, in an inhomogeneous plasma, the whistlers propagating along the magnetic field are not collisionlessly damped. In a plasma with a density gradient perpendicular to the magnetic field, it is natural to assume that the waves have $k_z \neq 0$. It is shown that this leads to the transformation of whistlers into potential waves of cold plasma and to the enhancement of damping. (MOW)

16319 NONLINEAR THEORY OF QUASIMONOCHROMATIC ELECTROSTATIC AND WHISTLER MODE PACKETS IN INHOMOGENEOUS PLASMA. Karpman, V. I.; Istomin, Ya. N.; Shklyar, D. R. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). pp 353 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The effects of the nonlinear interaction of waves with resonant particles were investigated. Because of the analogy between electrostatic waves and whistlers, one can consider these two modes simultaneously. However, for clarity, it is convenient to discuss at first the electrostatic waves. In this case, the mean deflection of the velocity of resonant particles from the phase velocity ω/k is of the order of $1/k\tau$, where τ is the characteristic period of oscillation of the trapped particles, i.e., $\tau = (m/e\epsilon_0 k)^{1/2}$ (ϵ_0 is the wave amplitude). In inhomogeneous plasma $\epsilon = \epsilon_0 \sin [\int_0^z k(z')dz' - \omega t]$ and the resonant velocity $v_R(z) = \omega/k(z)$ varies. That results in the permanent renovation of the resonant region. The kinetic equation for the resonant particles is described. (MOW)

16320 STRUCTURE OF THE WAVE FIELD NEAR THE HYBRID FREQUENCIES AND APPLICATION TO INCOHERENT SCATTERING. Fichet, M.; Fidone, I.; Granata, G. (CEN, Fontenay-aux-Roses, France). pp 354 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A plasma slab with a smooth density gradient directed along x, normal to the faces and to the external magnetic field directed along z is considered. An incident wave is considered. The electromagnetic field in the resonance region was studied. The spectrum of the incoherent scattering when the resonance region is accessible was also studied. (MOW)

16321 ALFVEN WAVE PROPAGATION IN A NONUNIFORM MAGNETIC FIELD. Cramer, N. F.; Paoloni, F. J. (Univ. of Sydney). pp 355 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Torsional Alfven waves in a cylindrical plasma, propagating along a magnetic field nonuniform in the direction of propagation, were studied previously. These waves propagating into a weaker field can, by choice of frequency, be made to encounter ion-cyclotron resonance beyond which the wave is heavily damped. Results are presented for $m = 0$ axisymmetric and $m = -1$ nonaxisymmetric waves of frequencies close to the ion-cyclotron frequency in the weaker field. (MOW)

16322 THEORETICAL AND EXPERIMENTAL STUDY OF THE ELECTRONIC LONGITUDINAL WAVE PROPAGATION IN A PLASMA WITH CUTOFF MAXWELLIAN DISTRIBUTION. Treguier, J. P.; Henry, D. (CNET, Lannion, France). pp 356 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

For free-oscillations and for a cutoff Maxwellian distribution, the linear Vlasov equation has been studied first by Weitzner and recently has been solved numerically by Canosa, et al. This problem is solved numerically for the forced-oscillation case. Theoretical and experimental results which are in good agreement are given. (MOW)

16323 ELECTROSTATIC WAVE REFLECTION IN A NONUNIFORM PLASMA. Ratner, A. S.; Roberson, C. W.; Hirshfield, J. L. (Yale Univ., New Haven). pp 358 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Measurements are presented for electrostatic wave propagation on a narrow plasma column with a suitable axial density gradient. While the plasma wave dispersion relation for waves on a narrow column differs from the dispersion relation for plasma waves in a radially unbounded plasma (where many of the theories have been developed), one is able to conclude that the frequency dependence of the reflection coefficient can be accounted for by a variant of the simple fluid theory, provided reflections are not too large. (MOW)

16324 THEORY FOR INCOHERENT SCATTER BASED ON THREE-WAVE INTERACTION. Harker, K. J.; Crawford, F. W. (Stanford Univ., CA). pp 359 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A general theory is given for scattering by density fluctuations excited by the random motion of plasma particles, commonly known as incoherent scattering. The theory generalizes previous high frequency theories in that it is valid for all frequencies of the incident and scattered electromagnetic waves. It does assume, however, a zero magnetic field, isotropic unperturbed charged particle velocity distribution functions, and the absence of multipl scattering. (MOW)

16325 STATIONARY WAVE EXCITATION IN PLASMA BY A MODULATED BEAM. Jungwirth, K.; Krlin, L. (Inst. of Plasma Physics, Prague). pp 379 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Numerical results are presented that describe the nonlinear interaction of a weak modulated beam with a single stationary one-dimensional wave, excited in a cold magnetic field free plasm The effect of all irreversible processes accompanying this interaction is simulated by a constant effective collisional frequency of plasma electrons. Starting from the nonlinear Poisson equation, expressions for the amplitude and phase of the excited wave are derived and then solved numerically, together with the equations of the beams particle motion. (MOW)

16326 EXCITATION OF THE NONLINEAR PLASMA WAVE BY A MODULATED BEAM. Jungwirth, K.; Sunka, P. (Inst. of Plasma Physics, Prague). pp 380 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Experimental and theoretical results are presented concerning the nonlinear interaction of a weakly modulated electron beam with a single beam-excited plasma wave. To explain the total loss of the beam energy in the quasistationary steady state it seems necessary to also include the absorption of the beam-excited wave, although binary collisions are negligible ($\nu_{ec} \approx 10^6$ sec^{-1}) and the fast wave cannot be absorbed by plasma electrons directly. One may assume that the simplest model with a constant effective collisional frequency ν_{eff} is able to give a staisfactory description of the whole process. (MOW)

16327 NONLINEAR COLD BEAM–PLASMA INTERACTION. Jungwirth, K. (Inst. of Plasma Physics, Prague). pp 381 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Theoretical and numerical results are described concerning the nonlinear interaction of an initially cold beam with a single wave $\omega \approx k_{\parallel} V_b$, excited in either magnetized or magnetic field free plasma. By using the energy and momentum conservation laws, equations describing the amplitude and phase of this wave are derived and solved numerically, together with the equations of the beam particles motion. Both temporal and spatial problems were studied. Although these two models have a lot of common features, there may be also a significant difference. Binary collisions are usually negligible. Some weakly nonlinear processes like parametric instabilities inside the plasma could, however, be responsible for the absorption of the beam-generated wave. (MOW)

16328 EXCITATION OF ELECTRON-PLASMA OSCILLATIONS BY LOW-FREQUENCY WAVES IN A BEAM–PLASMA DISCHARGE. Kirdyashev, K. P.; Polyakov, V. M. (Inst. of Radio Engineering and Electronics, Moscow). pp 382 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The interaction of the different waves in a plasma causes the occurrence of the stationary oscillations spectrum. It is well known that the low-frequency oscillations can be excited, when the high-frequency instabilities take place. In this case the conversion of energy from the electron-plasma oscillations to the ion-sound waves is observed. It is interesting to investigate the influence of the low-frequency waves on the high-frequency spectrum. The excitation of the electron-plasma oscillations by the low-frequency waves was observed. The assumption of the appearance of the accelerated electrons in the low-frequency field was supported by the experimental results. (auth)

16329 EXCITATION OF ELECTROMAGNETIC WAVES BY A GROUP OF FAST MONOENERGETIC ELECTRONS. Kaladze,

T. D.; Lominadze, D. G. (Tbilissi State Univ., USSR). pp 383 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Electromagnetic waves in the region of frequencies $\omega_{se} \geq \omega \gg \omega_{si}$ are considered, assuming that their phase velocity is much higher than the thermal velocity of electrons, and the wavelength is much larger than the Larmor radius of electrons. In such a case, the main part of electrons may be considered cold. Taking into account that the density of fast electrons is much smaller than the density of cold electrons an expression is derived for the density of electromagnetic waves. (MOW)

16330 LONGITUDINAL ELECTROMAGNETIC WAVE EXCITATION IN PLASMA AT HOLLOW RELATIVISTIC ELECTRON BEAM. Ivanov, S. T. (Univ., Sofia). pp 384 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

A relativistic electron beam, moving with a velocity μ in a conducting waveguide of radius R, filled with plasma, having a density n_2 is considered. There is a steady magnetic field aligned with the axis of the guide, keeping the beam from spreading and being bigger than intrinsic field of the beam current. (MOW)

16331 STRUCTURE OF THE OSCILLATIONS AT THE NONLINEAR BEAM-PLASMA INTERACTION. Rogashkova, A. I.; Tseitlin, M. B. (Inst. of Radio Engineering and Electronics, Moscow). pp 385 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovakia Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The nonlinear oscillation development over an extended region at the current beam modulation by multiple frequency signals is considered. The possibility of control of the output spectrum changing the parameters determining modulation on the system input is investigated. A one-dimensional disc space charge model is considered. The effect of limited cross-dimensions of the beam-plasma system on the longitudinal high-frequency field accounts for the field reduction factor. (MOW)

16332 INVESTIGATION OF ION LANGMUIR OSCILLATIONS IN A PLASMA—FAST ION BEAM SYSTEM. Gabovich, M. D.; Goncharov, A. A.; Poritskii, V. Ya.; Protsenko, I. M.; Soloshenko, I. A. (Inst. of Physics, Kiev). pp 395 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Excitation of ion Langmuir plasma oscillations by a fast ion beam ($V_0 \gg C_S$, where C_S is the velocity of the ion sound) was found; linear and nonlinear stages of the development of these oscillations were studied and it is shown that according to the theory the oscillations are suppressed by a magnetic field. (MOW)

16333 EFFECTS OF HIGHLY-IONIZED IMPURITIES ON COLLISIONLESS DRIFT WAVES. Gravier, R.; Lampis, G.; Samain, A. (CEN, Fontenay-aux-Roses, France). Nucl. Fusion; 14: No. 5, 621-628(Nov 1974). (In French).

A numerical study is presented of the effect of impurity gradients on collisionless drift waves. In the region where the usual simplifying hypotheses (wavelength transverse to the containment field greater than Larmor radii; longitudinal phase velocity differing greatly from thermal velocities) permitting analytical solution of the dispersion relation are not justified, this study provides a series of data on the extent of unstable zones and on the influence on the representative parameters of impurities. It confirms the appearance of an ion branch, possibly more unstable than the electron branch, which can develop on small wavelengths along the magnetic field and which cannot easily be stabilized by shearing the field lines. It is shown that the expected effect of this instability is to introduce into the contained plasma the impurities present at its boundary. (auth)

16334 PARAMETRIC EXCITATION OF ION BERNSTEIN WAVES IN A PLASMA WITH TWO ION SPECIES. Harms, K. D.; Hasselberg, G.; Rogister, A. (Kernforschungsanlage Juelich, Ger.). Nucl. Fusion; 14: No. 5, 657-668(Nov 1974).

The stability of ion Bernstein waves (frequency ω, wave number $\vec{k}$) in a plasma with two ion species pumped by a magneto-acoustic wave (ω_p, $\vec{k}_p$) which propagates perpendicularly to the static magnetic field is studied. The background plasma is assumed to be infinite, homogeneous and collision-free. If $\omega_p > |\omega|$ is properly chosen, ion Bernstein waves become unstable (decay instability, nonlinear Landau instability) at rather low values of the pump electric field amplitude $|\vec{E}_p|$. The instability is excited by the relative drift motion of different species induced by the pump wave. Assuming $|\vec{k} \cdot (\vec{D}_a - \vec{D}_b)| \ll 1$ ($\vec{D}_a$ = displacement for particles of species a, a = e, 1,2) the general nonlinear dispersion relation is approximately solved in a deuterium-tritium plasma for two different $\vec{k}$: In case A ($\vec{k} = \vec{k}_\perp \parallel \vec{k}_p$) only the relative ion motion $\vec{D}_d - \vec{D}_t$ comes into play; this gives rise to decay instabilities which are only present in plasmas with two ion species. The instabilities of case $B_\perp (k_\perp \perp k_p, k_z \neq 0)$ caused mainly by the relative electron-ion drift motion are similar to those in plasmas with only one ion species. For given $|\vec{E}_p|$ the growth rates in both cases are equal in order of magnitude (for low values of ω_p, case A is slightly more favorable); however, in case A the theory is valid up to considerably higher values of $|\vec{E}_p|$. Some effects depending substantially on the presence of two ion species are discussed in detail. (auth)

16335 INFLUENCE OF AN EXTERNAL FIELD ON WAVE—WAVE INTERACTION COEFFICIENTS. Stenflo, L. (Umeaa Univ., Sweden). Phys. Scr.; 9: No. 6, 341-342(Jun 1974).

The resonant generation of an electrostatic plasma wave by means of two other waves is considered. It is shown that the coupling coefficient is changed into a certain time-dependent function when an external periodic electric field is applied. (auth)

16336 INTENSE COHERENT CHERENKOV RADIATION DUE TO THE INTERACTION OF A RELATIVISTIC ELECTRON BEAM WITH A SLOW—WAVE STRUCTURE. Carmel, Y.; Ivers, J.; Kribel, R.E.; Nation, J. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853). Phys. Rev. Lett. 33: No. 21, 1278-1282 (18 Nov 1974).

Extremely high—power microwave emission is generated when a pulsed relativistic electron beam propagates down the axis of a corrugated—wall wave guide. The radiation occurs at a frequency such that the phase velocities of the negative—energy space charge wave on the beam and a low—order TM mode in the wave guide are equal. Power levels of 500 MW are generated. The conversion efficiency of electron energy into electromagnetic energy radiation is 17%. (auth)

16337 LOWER HYBRID WAVE CONVERSION FOR A PARABOLIC DENSITY PROFILE. Fidone, I.; Paris, R.B. (Association Euratom—CEA sur la Fusion, Département de Physique du Plasma et de la Fusion Contrôlée, Centre d'Etudes Nucleaires, 92260 Fontenay—aux—Roses, France). Phys. Fluids 17: No. 10, 1921-1922 (Oct 1974).

Linear wave conversion at the lower—hybrid layer for a parabolic density profile is investigated. It is found that total conversion of the incident flux in the direction of the density gradient takes place. (auth)

16338 PARAMETRIC EXCITATION BY MAGNETOSONIC WAVES IN A MULTISPECIES PLASMA. Sperling, J.L.; Perkins, F.W. (Plasma Physics Laboratory, Princeton Unversity, Princeton, New Jersey 08540). Phys. Fluids 17: No. 10, 1857-1859 (Oct 1974).

A magnetosonic pump wave propagating in a plasma with two ion species decays into two electrostatic ion—cyclotron modes at a threshold significantly less than those needed to excite parametric or modified two—stream instabilities in a single—species plasma when $T_e/T_i > 1$. The pump wave frequency must somewhat exceed the sum of the ion gyrofrequencies. (auth)

16339 NONLINEAR PROPERTIES OF HIGH AMPLITUDE IONIZATION WAVES. Grabec, I. (Department of Mechanical Engineering, University of Ljubljana, Ljubljana, Yugoslavia). Phys. Fluids 17: No. 10, 1834-1840 (Oct 1974).

Nonlinear equations describing the state of a weakly ionized plasma in an unstable positive column are derived from a set of hydrodynamic equations, the Poisson equation, and the ionization frequency equation for the direct ionization process. In order to find the solution of the initial value problem, an interative method is applied. Numerically solved examples show that unstable ionization waves develop into high amplitude relaxation waves—striations. From the calculated distributions of the governing physical quantities particle—like properties of high amplitude striations are established. A nonlinear interaction between striations leading to their collision is noted. The explosive nature of ionization instability is found to be most pronounced at low ionization losses of electron energy. A quantitative, as well as qualitative agreement between calculated and experimental data is obtained. (auth)

16340 QUASILINEAR THEORY OF BEAM—GENERATED SURFACE WAVES IN A PLASMA. Pakhomov, V.I.; Sizonenko, V.L. Sov. Phys.—Tech. Phys. 19: No. 5, 630-634 (Nov 1974).

A system of quasilinear equations is obtained that describes the interaction of a beam of charged particles with electrostatic surface waves in a semiinfinite magnetoactive plasma. The quasilinear integral and the spectrum in the final stage are found. (auth)

16341 WAVE INTERACTION IN A THIN PLASMA SHEATH. Pashchenko, A.V.; Rutkevich, B.N. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Tech. Phys. 19: No. 6, 726-731 (Dec 1974).

Electron oscillations in a plasma sheath in a strong longitudinal magnetic field are investigated. The model of a thin plasma sheath is substantiated, and solutions of the simple wave type are found and analyzed. The wave interaction in a thin plasma sheath is solved exactly. Simple asymptotic expressions are derived from the exact equations for a number of cases of practical importance. (auth)

16342 PERTURBATION OF PLASMA BY STRATIFIED ELECTROMAGNETIC RADIATION. Woods, C.H. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 18: No. 1, 67-72 (Jan 1975).

An analysis is presented of the density perturbation produced in a warm plasma by a stratified electromagnetic wave. Filamented wavefields of arbitrary polarization with an intensity distribution which is doubly periodic in the transverse coordinates are considered. The analysis is based on second—order perturbation theory, and comparisons are made with the procedure leading to the well—known ponderomotive potential. (auth)

16343 CONDITION FOR SLOW WAVE PROPAGATION IN PLASMAS. Gagliardi, L.J. (Physics Department, Rutgers University, Camden, New Jersey 08102). Phys. Fluids 18: No. 1, 73-76 (Jan 1975).

A new general condition for the propagation of slow waves in plasma waveguide systems is derived from the full boundary value problem. Unlike previous calculations, a nonzero collision frequency is retained throughout. The plasmas are assumed to constitute the center conductor of a coaxial waveguide system. (auth)

16344 DYNAMICS OF AN ENSEMBLE OF PLANE WAVES IN NONLINEAR DISPERSIVE MEDIA. Hasegawa, A. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Fluids 18: No. 1, 77-79 (Jan 1975).

A statistical description of the dynamics of an ensemble of plane waves in nonlinear and strongly dispersive media is derived. A modulational instability, a second sound wave, and a localized group of waves are obtained from the description. The results apply to the dynamics of many optical waves in strongly dispersive dielectric media with the Kerr effect as well as plasma waves for which decays or the wave particle interactions are prohibited. (auth)

16345 RELATIVISTIC EFFECTS IN MAGNETOHYDRODYNAMIC WAVE PROPAGATION. Murphy, G.L. (Department of Physics, Westminster College, New Wilmington, Pennsylvania 16142). Phys. Fluids 18: No. 1, 112-114 (Jan 1975).

Relativistic modifications of Alfvén waves are discussed for cases in which magnetic and relativistic terms are comparable. For atmospheric waves there are corrections to velocities, amplitudes, and polarizations. The mass current of the wave itself causes dispersion. (auth)

16346 ENHANCEMENT OF DAMPING OF A LARGE AMPLITUDE WAVE. Sugihara, R.; Yamanaka, K. (Institute of Plasma Physics, Nagoya University, Nagoya, Japan). Phys. Fluids 18: No. 1, 114-116 (Jan 1975).

By evaluating the exact population difference between resonant electrons with velocities smaller and larger than the phase velocity, a correction to Landau damping proportional to the square of the wave amplitude is obtained theoretically. (auth)

16347 DAMPING AND SATURATION OF ELECTRON PLASMA WAVE ECHOES. Moeller, C. (California Institute of Technology, Pasadena, California 91125). Phys. Fluids 18: No. 1, 89-95 (Jan 1975).

A description is given of theoretical and experimental work on the damping of a second—order electron plasma wave echo due to velocity space diffusion in a low temperature magnetoplasma. Sufficient precision was obtained to verify the theoretically predicted cubic rather than quadratic or quartic dependence of the damping on exciter separation. Compared with the damping predicted for Coulomb collisions in a thermal plasma in an infinite magnetic field, the magnitude of the damping was approximately as predicted, while the velocity dependence of the damping was weaker than predicted. The discrepancy is consistent with the actual non—Maxwellian electron distribution of the plasma. In conjunction with the damping work, echo amplitude saturation was measured as a function of the velocity of the electrons contributing to the echo. Good agreement was obtained with the predicted J_1 Bessel function amplitude dependence, as well as a demonstration that saturation did not influence the damping results. (auth)

ENGINEERING

Energy Conversion

16348 MEASUREMENTS OF CROSS SECTIONS FOR THERMAL ELECTRON SCATTERING ON Cs AND Ba ATOMS. Babanin, V. I.; Dunaev, Yu. A.; Mustafaev, A. S.; Sitnov, V. I.; Ender, A. E. (Ioffe Inst. of Physics and Tech., Leningrad). pp 2 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).
From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).
A measurement method is described that uses some peculiarities of the transverse magnetic field influence upon the current in a thermionic converter with an operating mode intermediate between collisionless and collisional modes. The thermionic converter with Cs–Ba vapors, is used whose main feature is that work function of its cathode can be varied in a wide range by varying Ba-vapor pressure, while ions are produced as a result of Cs-vapor ionization. (MOW)

Facilities and Equipment

Refer also to abstract 16677.

16349 (AECL-4834) STRESSES AND DEFORMATIONS IN ELASTIC PLASTIC STRUCTURES IN CONTACT UNDER COMPRESSION: PLANE STRUCTURES. Hatton, H. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1974. 73p. Dep. NTIS (US Sales Only) $6.75. AECL $1.50.
A Fortran program EPPLIC (Elastic-Plastic Plane Structures In Contact) to calculate the deformations and stresses in two plane structures in contact under compression is presented. The main features of the program are: the inclusion of plastic deformation; and varying boundary conditions along the mating surface between the structures to ensure that loads are only transmitted at nodes which are in contact and that one structure cannot intrude into the other. (auth)

16350 (AGC-2309) THEORETICAL AND EXPERIMENTAL EVALUATION OF TEST CELL "D" EJECTOR SYSTEMS (HOT FLOW PROGRAM). Mandell, B.; McFarland, B.; Nelson, R.; Patmor, G. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1962. Contract AT(29-2)-1060. 171p. Dep. NTIS $11.75.
An experimental and theoretical evaluation of two specific ejector systems was made to determine the applicability of the designs for use as exhaust disposal systems in Test Cell "D". The experimental tests were made with 1/11 scale models using cold and heated nitrogen to simulate the exhaust gases. Data on gas dynamics, heat transfer, film cooling effects, secondary ejector performance, purge characteristics, combined flow start up, and back flow problems, were obtained during this work. Design implications are drawn as a result of the experimental and analytical data. (auth)

16351 (AGC-2408) PRELIMINARY DESIGN FOR ADDITIONS TO ENGINE TEST STAND NO. 1. Nuclear Rocket Development Station, Jackass Flats, Nev. (Aetron, Covina, Calif. (USA)). 1 Nov 1962. 64p. Dep. NTIS $6.25.
This report covers preliminary design of additional facilities to be incorporated in Engine Test Stand No. 1, Area 400, Jackass Flats, NRDS, Nevada. The facilities include: change house and shielded passageways to test cell building; blast valve in tunnel; closure of tunnel entrances; change facilities in tunnel to equipment room; stiles over pipeways; dikes around liquid hydrogen storage dewar; hydrogen gas detectors at facilities fresh air intake; and radiation monitor at fill station tunnel entrance. (auth)

16352 (AGC-2408A) PRELIMINARY DESIGN FOR ADDITIONS TO ENGINE TEST STAND NO. 1. Nuclear Rocket Development Station, Jackass Flats, Nev. (Aetron, Covina, Calif. (USA)). 17 Jan 1963. 58p. Dep. NTIS $6.00.
This report covers preliminary design of additional facilities to be incorporated in Engine Test Stand No. 1, Area 400, Jackass Flats, NRDS, Nevada. The facilities include: change house and shielded passageways to test cell building; blast valve in tunnel; closure of tunnel entrances; change facilities in tunnel to equipment room; stiles over pipeways; dikes around liquid hydrogen storage dewar; hydrogen gas detectors at facilities fresh air intake; and radiation monitor at fill station tunnel entrance. (auth)

16353 (AGC-2474) NERVA EXHAUST DUCT, ETS-1 AGC-2 LARGE RADIUS ELBOW. Volume I. Preliminary Design Report. (Aerojet-General Corp., Azusa, Calif. (USA)). Aug 1963. 215p. Dep. NTIS $13.75.
A 5-month preliminary design effort was expended on the large-radius elbow duct for the NERVA Exhaust System (NES) for ETS-1. The NES was designed to provide operational safety, full altitude simulation, and testing capability for a 40 to 1 area ratio nozzle with 1° of gimbal action for the ETS-1 Facility. This effort was conducted under Subtask 3.1 of the SNP-1 contract for CY 1963, and covered a preliminary design period from Sept. thru Dec. 1962. (auth)

16354 (AGC-2506(Add.1)) ETS-1 FLUID REQUIREMENTS ADDENDUM. (Aerojet-General Corp., Azusa, Calif. (USA)). Jun 1963. 8p. Dep. NTIS $4.00.
The ETS-1 Fluid Requirements delineated in Report 2506 are based upon specific ground rules which define a static test facility capable of the reference test plan described in the report. If these ground rules were changed to reflect a static test facility capable of a lesser specifically defined test plan, the ETS-1 fluid requirements could be reduced. This addendum defines the minimal ETS-1 fluid requirements based on such a reduced test plan. (auth)

16355 (AGC-2668) STRUCTURAL INTEGRITY TESTS RECTANGULAR COOLANT CHANNELS ETS-1 NES DUCT. (Aerojet-General Corp., Azusa, Calif. (USA)). Aug 1963. 28p. Dep. NTIS $4.50.
Sample coolant channels, for possible use in the design of the ETS-1 primary and secondary portion of the NES exhaust duct, were fabricated and structurally tested. Results indicate the maximum proof-pressure requirement for the structural capability of the coolant channels was met by the sample design as well as the cyclic life, tensile test of the welds and the burst test requirements. (auth)

16356 (AGC-2680) EXPERIMENTAL EVALUATION OF SECONDARY PUMPING SYSTEMS FOR ETS-2. (Aerojet-General Corp., Azusa, Calif. (USA)). Dec 1963. 96p. Dep. NTIS $8.00.
This report is a presentation of the data, results, and analysis of a test program conducted under Contract SNP-1, sub-subtask 3.1.2. The program was conducted to investigate the effects of secondary ejector working fluids of various molecular weights in relation to their characteristics which enable the nozzle of a test engine, using hydrogen as a propellant, to flow full at low values of chamber pressure. The specific purpose of this program was to provide design and pumping criteria for the secondary ejector for Engine Test Stand No. 2 (ETS-2). (auth)

16357 (AGC-2699) NES DUCT (SST-2) CONCEPTUAL DESIGN. (Aerojet-General Corp., Azusa, Calif. (USA)). Sep 1963. 40p. Dep. NTIS $5.00.
After the duct internal configuration and performance was established by the various scale model test programs (REON Report 2678) several design approaches for the duct were generated and evaluated. A design concept was selected in coordination with SNPO-C and was the basis for preliminary design of the NES duct for ETS-1. The basic decisions made at this time concerned: selection of coolant channel configurations for each duct section; selection of materials; and selection of basic fabrication techniques. (auth)

16358 (CEA-N-1722) DEVICE FOR THE CONTAMINATION OF LABORATORY ANIMALS BY INHALATION OF RADIOACTIVE AEROSOLS. Metivier, H.; Rateau, G.; Masse, R.; Nolibe, D. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). Jul 1974. 17p. (In French). Dep. NTIS (US Sales Only) $4.00.
A system has been developed for the administration of $^{239}PuO_2$ aerosols to rats, rabbits, dogs, and monkeys by inhalation. The enclosure is fitted with an air circulation system, the aerosol generator produces standardized dry aerosols, and the aerosol concentration can be regulated. The successive safety devices and restraining devices for the animals are also described. (FR)

16359 (HEDL-TME-72-122) HEDL RECOMMENDATION FOR NON-RADIOACTIVE, SODIUM-WETTED COMPONENT HANDLING AND CLEANING. Nash, C. R.; Robinson, J. E.; Garrett, E. E.; Shoemaker, F. M.; McBride, J. P.; Toyoda, K. G. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 5 Oct 1972. Contract AT(45-1)-2170. 97p. AT.
The proposed Sodium Removal System (SRF) for handling and cleaning non-radioactive sodium-wetted components from the High Temperature Sodium Facility, from early Fast Flux Test Facility operations, and from the Fast Flux Test Facility secondary sodium system throughout plant life is described. The SRF consists of a

75-ft × 75-ft reinforced concrete pad with a pit area located adjacent to the pad to accommodate installation and operation of a 10-ft dia × 40-ft vertical cleaning vessel and associated process equipment. The latter equipment will include auxiliary equipment for the cleaning process, waste disposal system, demineralized water system, necessary monitoring and control equipment for the cleaning process, and facility services. Handling of components to be cleaned in the SRF will be accomplished with a crawler crane. (TFD)

16360 (NTO-R-0160) RMSF FLATCAR BRAKE AND SPACECAR COUPLER. NTO Design Report. Fuchs, C. E. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 18 Oct 1968. 30p. Dep. NTIS $4.50.

This design report was prepared in response to two design requests from E-MAD Operations. The first request was for design of a set of failsafe brakes to replace the RMSF flatcar brakes and, in the process, furnish remote braking capability. The second request was for redesign of the spacercar coupler to eliminate unintentional decoupling. Both of these designs have been completed and are presented. During the return of Phoebus II and subsequent to completing this coupler redesign, another instance of unintentional decoupling developed. This decoupling precipitated a search for commercially available couplers. Three couplers were found and evaluated for use on the RMSF flatcars. No attempt was made to evaluate these couplers for use on the test car. However, WANL-GSE was informed of the search and briefed on the coupler possibilities. (auth)

16361 (ORNL-tr-2830) MECHANICS OF PRESSURE APPARATUS. Relation to Materials Problems. Labbens, R. 1973. Translated from French. (CONF-7310100-1). 65p. Dep. NTIS $6.25.

From international meeting on metallurgy; Paris, France (4 Oct 1973).

The growing importance of pressure vessels in modern industrial life is emphasized, and the discrepancies between national regulations are pointed out. The possible failure modes, of pressure vessels, excessive deformation, plastic instability, progressive distortion, fatigue cracking, fast fracture, creep are studied. It is shown how design rules can be related to the prevention of the failure modes. It is noted that most damages have been known for a long time, and that rather simple rules have practically prevented such failures. However fast fracture for instance was disconcerting, and has extended as the tensile properties of the materials and the dimensions of the vessels were increased. It is only recently that the developments of classical elasticity and plasticity and fracture mechanics have allowed more accurate design rules while the limits of validity of the old rules were better known. Much work is still necessary, but the progress of stress and strain analysis should result in making national regulations more similar. Attention is drawn on the fact that, if the developments of mechanics and metallurgy make a better analysis possible, significant specifications and utilization data are necessary. The manufacturer is a link of the safety chain; the regulatory authorities, the process owner and the user are others by the definition of the permissible risks and the utilization data. (auth)

16362 (RN-S-0349) OPERATING AND MAINTENANCE INSTRUCTIONS FOR XE-1 TEST STAND CONTROL SYSTEM (TSCS) PROCESS SYSTEM CONTRÓL SUBSYSTEM. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1968. 244p. Dep. NTIS $15.25.

This operation and maintenance instruction manual contains the general description, installation procedures, theory of operation, maintenance instructions, and troubleshooting procedures for TSE Console 09, which is part of the Process System Control, Test Stand Control System (TSCS) for ETS-1. (auth)

16363 (RN-S-0500) NERVA ALTITUDE-SIMULATION SYSTEM MODIFICATION PLAN. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1969. 60p. Dep. NTIS $6.25.

The purpose of this modification plan is to outline the requirements, define the responsibilities, define the preparation of criteria, and design documents for the NERVA-Altitude-Simulation-System (NASS), as well as to define the preliminary and final design of the NASS duct and to authorize preparation of the design criteria for the NASS steam system. (auth)

16364 (RN-S-0512) BENHAM SEISMIC EVENT SUMMARY REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1969. 49p. Dep. NTIS $5.50.

Precautionary measures were taken prior to the Benham Event to prevent damage of ETS-1 and E-MAD in the event of an unusually high anomaly. ETS-1 modifications were accomplished under the jurisdiction of the Facilities Division, Space Nuclear Propulsion Office-Nevada. Post-event inspection revealed no damage to either ETS-1 or E-MAD. A chronology of events is presented as are selected photographs of modifications made to ETS-1. (auth)

16365 (RN-S-0542) SEISMIC-RESPONSE ANALYSIS OF ENGINE TEST STAND NO. 1. Tow, D. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1969. 78p. Dep. NTIS $7.00.

A detailed seismic-response analysis of ETS-1 has been completed, and the two main objectives of the analysis were met: (1) to establish a valid structural dynamic model for the test stand and (2) to predict test-stand dynamics under the influence of future nuclear events and initiate appropriate strengthening measures. A structural dynamic model of ETS-1 was developed as the basis for this investigation; the model shows good correlation between predicted and actual test-stand frequency and responses. The measured fundamental test-stand frequency shows a mean value of 2.08 Hz for motion perpendicular to the shield wall as compared with an analytical value of 1.96 Hz. In addition, results of the modal analysis show that ETS-1 exhibits many other theoretical resonant frequencies. There are 37 such frequencies below 50 Hz, of which 19 are below 20 Hz. (auth)

16366 (RN-TM-0237) PRELIMINARY ETS-1 DESIGN SAFETY EVALUATION. Duncan, D. S.; Booth, H. R.; Klein, S. H. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1965. 150p. Dep. NTIS $10.50.

The safety aspects associated with the systems currently comprising the ETS-1 complex are evaluated. Basically, the designs of these systems were found to be adequate to support the X-Engine test program. All of the safety deficiencies noted can be corrected with nominal effort and expense, either through the procurement of additional, relatively low-cost equipment, or by relatively minor modifications to existing designs and/or operating procedures. It is emphasized that this evaluation is neither final nor all inclusive. It is planned that the design safety evaluation of the ETS-1 complex will continue until all facility and engine system designs are finalized, and the facility activation and checkout is complete. Though, in this sense, the present evaluation is preliminary, it is felt that all major safety deficiencies and/or problems inherent to the current ETS-1 system designs have been identified. The significant recommendations resulting from this evaluation are summarized. (TFD)

16367 (RN-TM-0344) SAFETY EVALUATION OF MANNED CONTROL CAR (MCC) AND ENGINE INSTALLATION VEHICLE (EIV). Booth, H. R.; Bybee, R. S.; Wu, M. K. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1966. 56p. Dep. NTIS $6.00.

A safety evaluation of the as-built Manned Control Car (MCC) and Engine Installation Vehicle (EIV) is presented. The MCC is to be used in conjunction with the EIV and a Prime Mover locomotive for the transport, installation, and removal of the NERVA nuclear engine in fulfillment of NERVA engine testing requirements. The MCC is a specially designed and constructed railway locomotive equipped with remote controls for the Prime Mover and EIV. These controls are located in the central control cab which is designed to shield the operators from the nuclear radiation environment. The EIV is a specially designed railway vehicle which is to be used to install or remove the NERVA engine from the test stand and to support this engine during transport between the test stand and the Engine Maintenance Assembly/Disassembly Building (E-MAD). All controls for the EIV are located in the MCC shielded cab. (TFD)

16368 (RN-TM-0415) INTERIM NUCLEAR ANALYSES IN SUPPORT OF E/STS 2-3 SITE LAYOUT ACTIVITIES. Whittum, H. O.; Warman, E. A.; Garrington, G.; Rogers, D. R. (Aerojet-General Corp., Sacramento, Calif. (USA)). 22 Dec 1966. 81p. Dep. NTIS $7.25.

This report presents the results of nuclear analyses performed during the first three month period of preliminary design activities for Engine/Stage Test Stand (E/STS) 2-3. These analyses are intended to provide supportive nuclear data for the site layout engineering effort. Nuclear data for the test stand design effort will be the subject of a later document. (TFD)

16369 (RN-TM-0570) HIGH-TEMPERATURE WATER PENETRATION, PRETEST PREDICTION. Margetts, M. J.; Geery, E. L. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1968. 113p. Dep. NTIS $8.75.

The E/STS 2-3 efforts conducted during development of ETS-1 were examined and evaluated to determine the relative advantages of wet and dry duct-elbow configurations. One of these elbow configurations, along with a new duct, will be used to test E-2 and subsequent NERVA engines in the existing ETS-1 facility. This evaluation, which was based on the significant parameters of cost, schedule, reliability, and safety, and which recognized the specific development problems for each system, resulted in the recommendation that the wet-elbow configuration be investigated further. This recommendation was made with full recognition of the potential problems associated with water injection and mixing, particularly in extrapolating subscale design data to full scale. After demonstrating a knowledge of these problems by way of a full-scale design, a series of large-scale, high-temperature tests was planned. This report outlines the analytical approaches used and gives the pretest predictions for this test program. (TFD)

16370 (TID/SNA-7) DESCRIPTION OF ENGINE TEST STAND ETS-1 INSTRUMENTATION AND CONTROL SYSTEMS CAPABILITIES NO. 741:M0759. (Aerojet-General Corp., Azusa, Calif. (USA)). 7 Jan 1964. 85p. Dep. NTIS $7.25.

The capabilities of the ETS-1 I & C system as designed by Edgerton, Germeshausen and Grier, Inc., under the technical direction of REON are described. The intent of the document is to provide concise I & C information for use in the activation planning effort of the facility, and to provide a reference of general interface information to other design disciplines within REON and WANL. (auth)

16371 (WANL-TME-267(Rev.A)) WANEF OPERATIONS MANUAL. Freidhof, W.E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1964. 131p. Dep. NTIS $9.75.

The controls and procedures by which the Westinghouse Astronuclear Experimental Facility (WANEF) at Waltz Mill, Pennsylvania, will ensure that the various nuclear critical experiments will be performed in a safe and efficient manner are presented. (auth)

16372 (WANL-TME-275) COMMENTS ON E-MAD PHASE II DRAWINGS RECEIVED FEBRUARY 6, 1963. Svasek, A. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 13 Feb 1963. 4p. Dep. NTIS $4.00.

Comments on drawings and design information received by WANL on the E-MAD Facility are presented. (TFD)

16373 (WANL-TME-278) COMMENTS ON E-MAD PHASE II DRAWINGS RECEIVED BETWEEN 2/14/63 AND 2/19/63. Svasek, A. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Feb 1963. 6p. Dep. NTIS $4.00.

16374 (WANL-TME-626) EVALUATION OF RESISTANCE (CAPACITOR DISCHARGE) WELDING FOR ATTACHING INSTRUMENTATION. Seaman, F. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Dec 1963. 16p. Dep. NTIS $4.00.

This report describes the evaluation of a capacitor discharge welding process for fastening instrumentation leads with straps to the core barrel and documents the qualification of the capacitor discharge equipment of MIL-W-6858 Class B. (auth)

16375 (WANL-TME-646(Rev.A)) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY CRITICALITY HAZARDS CONTROL PROCEDURE. Frantz, F. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 33p. Dep. NTIS $4.75.

The rules and regulations by which the Westinghouse Astronuclear Experimental Facility (WANEF) will ensure that non-reactor fuel operations carried out at the facility will be nuclearly safe are presented. (auth)

16376 (WANL-TME-646(Rev.B)) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY NUCLEAR SAFETY MANUAL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1967. 32p. Dep. NTIS $4.75.

The rules and regulations by which the Westinghouse Astronuclear Experimental Facility (WANEF) will ensure that non-reactor fuel operations carried out at the facility will be nuclearly safe are presented.

16377 (WANL-TME-646(Rev.C)) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY NUCLEAR SAFETY MANUAL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1968. 5p. Dep. NTIS $4.00.

The rules and regulations by which the Westinghouse Astronuclear Experimental Facility (WANEF) will ensure that non-reactor fuel operations carried out at the facility will be nuclearly safe are presented. (auth)

16378 (WANL-TME-646(Rev.D)) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY NUCLEAR SAFETY MANUAL. Frantz, F. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1969. 33p. Dep. NTIS $4.75.

The rules and regulations by which the Westinghouse Astronuclear Experimental Facility (WANEF) will ensure that non-reactor fuel operations carried out at the facility will be nuclearly safe are presented. (auth)

16379 (WANL-TME-942) NRX DONNER AMPLIFIER HYBRID POWER SUPPLY OPERATIONAL MANUAL. Schatz, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Sep 1964. 35p. Dep. NTIS $4.75.

The specifications, design conditions, set up and operating procedures, and trouble shooting routines for the NRX Donner Amplifier hybrid power supplies for use in the NRX reactor tests to be conducted from Control Room A are presented. (WHK)

16380 (WANL-TME-947) TEST CELL A EQUIPMENT ACQUISITION: CY 1965, CY 1966. Kutilek, J.; Vuckovich, M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Sep 1964. 29p. Dep. NTIS $4.50.

Operational testing of nuclear reactors for rocket propulsion is carried out in two complexes at the Nuclear Rocket Development Site. Test Cell "A" is the older of these testing areas, and is to be associated with NERVA system testing; Test Cell "C" has been used for KIWI and will be used for Phoebus reactors. Presently, both test cell complexes share equipment in the control point and use the same maintenance and assembly (R-MAD Building) capability. Such combined operation presents certain operational difficulties. It is impossible to completely check out and operate the data acquisition system in one test cell while the other cell is in operation. Certain control point equipment is shared and must be moved or repatched to provide operation with the other test cell. Conflicting operations exist in the R-MAD Building which cannot be resolved until the E-MAD Building is operational. It is estimated that six (6) weeks are required between hot test reactors for disassembly, scrubbing of facilities, and preparation for the next reactor. Originally it was not intended that the test cells be operated or checked out simultaneously. However, with the entrance of the NERVA team, certain simultaneous operations became necessary to avoid unacceptable delays between reactor tests. The present document delineates the equipment to be provided in Contract Year 1965 and 1966 to provide the degree of operation required and for the expansion and updating of Test Cell "A". (auth)

16381 (WANL-TME-1002) ELM-3 SHOCK CALIBRATION. Burack, R. D. (Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.). Oct 1964. 18p. Dep. NTIS $4.00.

This report describes two methods available at WANL which are capable of applying the inputs required for the EML-3 Full Reactor Shock Test Series. The results from the actual test are presented in WANL-TME-982. A pre-test calibration, completed in July 1964, was performed in order to determine the specific characteristics and limitations of each system. Both systems are capable of applying a satisfactory half-sine input to the reactor although each has specific advantages. A 10 G shock of 10 ms duration is the maximum magnitude shock which can be applied by the thrusters. The sand drop applied shock spectrum is somewhat higher in the low frequency range from 0 to 10 cps. (auth)

16382 (WANL-TME-1280) HIGH TEMPERATURE INSTRUMENTATION QUALIFICATION FURNACE RADIATION HEAT SHIELDS. Ferris, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 33p. Dep. NTIS $4.75.

Two radiation heat shields have been designed for use in a hydrogen atmosphere in the High Temperature Instrumentation Qualification Furnace. Their performance is described, and the method of performance analysis is indicated. The two designs differ only in the number of concentric refractory-metal shields. The 9-shield assembly requires approximately one kW of radial driving power per inch of axial length to schedule the necessary temperature gradient from 5000°R at the heater element to 750°R at the water jacket; the average of the temperature difference from shield to shield is approximately 200°R. The 4-shield assembly requires almost twice the radial driving power compared to the 9-shield assembly; at high temperature the average of the temperature difference from shield to shield is likewise approximately double, i.e., 400°R. The analysis considers only radial heat transfer by radiation and by conduction through the hydrogen gas. Indication is given as to the origin of the design from a simplified radiation-only approach. The results are compared with the expected performance of a carbon-felt-thermal insulating assembly for use in helium. (auth)

16383 (WANL-TME-1285) OPERATIONAL MANUAL FOR THE XE-1 HIGH VOLTAGE POWER SUPPLY (938J164). Bush, N. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1966. 39p. Dep. NTIS $5.00.

This operational manual contains the general description, theory of operation, alignment procedures, maintenance, and repair data for the XE-1 High Voltage Power Supply. The power supply is a transistorized high regulation, low ripple power supply providing two isolated variable output voltages, one adjustable between 50 and 500 VDC at 0 to 20 mA, the other, −10 to −300 VDC at 0 to 2 mA. (WHK)

16384 (WANL-TME-1546) OPERATIONAL MANUAL FOR SOURCE DRIVE CONTROL CHASSIS. Kowalcheck, H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Nov 1966. 33p. Dep. NTIS $4.75.

This operational manual covers the Source Drive Control Chassis that is located in Rack 44 at the Test Cell Building. This chassis contains the fuses, switches, and various components and modules that are associated with the Source Drive Control System. Other controls and displays associated with the Source Drive Control System are located on the LRE Console Startup Panel at the Control Point Building. (auth)

16385 (WANL-TME-1704) OPERATIONAL MANUAL FOR XE-1 EXPERIMENTAL CONTROLLER NO. 1 (ETS-1). Bartholomew, R. R.; Bush, N. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1967. 114p. Dep. NTIS $8.75.

This operational manual covers the XE-1 Experimental Controller No. 1 Chassis located in Rack 48 and identified by the reference designation 48A6. This chassis contains fuses, test jacks, and the circuit boards for the various subsystem circuits in the chassis. Each subsystem circuit description is complete within the section for that subsystem. Test specifications, photographs, and drawings, which in some instances are common to more than one subsystem, are combined at the end of this manual. (auth)

16386 (WANL-TME-1743) MEASUREMENT OF THE IMPEDANCES OF THE INDUCTOTHERM ELEMENT COATING FURNACES. Malick, F. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Apr 1968. 73p. Dep. NTIS $6.75.

A test and analysis program was performed to determine a method for obtaining large temperature gradients necessary in the preparation of fuel elements for nuclear reactors. The impedances of one inductotherm element coating furnace were measured as a necessary step toward understanding the theory of operation of the furnace. The detailed procedures for running the furnace tests and the detailed calculations used to reduce the data are given. The problems with instrumentation are discussed and recommendations are given for improvements for future similar tests. The self and mutual impedances for all three furnace zones for both hot and cold furnaces are provided along with the impedances of the 75 and 360 kVA saturable reactors used for furnace control. (auth)

16387 IMPROVEMENTS IN PLATE HEAT-EXCHANGERS AND ENERGY GENERATING THERMAL INSTALLATIONS COMPRISING SAME. (to Societe Babcock-Atlantique). French Patent 2,182,686/E/. 4 May 1972. 15p. (In French).

The exchanger, mounted within an enclosure, comprises juxtaposed vertical plates, alternately provided with corrugations having two directions, a compartment defined by two of such plates being thus provided with two channel networks at an angle with respect to each other. (FR)

Lasers

16388 (AD−781156) RADIATION FIELD STRUCTURE DURING SYNCHRONIZATION OF TRANSVERSE MODES IN A LASER. Kovalenko, E. S.; Kushch, G. G. Translated from Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 2, 156-158(1973). 156-158p. (FSTC-HT-23-1846-73). NTIS $3.00.

Since synchronization of transverse oscillations of a laser can result in scanning of output radiation, the distribution of amplitudes and phases of transverse modes of laser oscillations was analyzed to correspond closely to conditions in real lasers. It was found that as the synchronized transverse modes increase in number, the modulation of the laser output radiation rises sharply. (auth)

16389 (AD−781264) CALCULATIONS FOR A VUV LASER FROM SODIUM VAPOR PUMPED BY RADIATION FROM AN EXPLODING WIRE. Jones, W. W.; Ali, A. W. (Naval Research Lab., Washington, D. C. (USA)). Jun 1974. 12p. (NRL-MR-2807). NTIS $3.00.

Calculations are carried out for A 372 Å laser from sodium using the blackbodylike radiation emitted from an exploding wire. The gain calculations indicate that such a laser is highly probable. (auth)

16390 (AD−782034) ROTATIONAL RELAXATION AND SELF-INDUCED TRANSPARENCY IN Hf GAS. Semiannual Report, 1 March 1973−31 August 1973. Peterson, L. M.; Lindquist, G. H.; Arnold, C. B. (Environmental Research Inst. of Michigan, Ann Arbor (USA)). May 1974. Contract DAAH01-73-C-0591. 39p. (ERIM-101300-16-P). NTIS $3.25.

The measurement of laser linewidth using time-resolved bleachable absorption of Hf gas is reported. The pin lasers were found to have a width of only 3 MHz, which is 120 times narrower than the Doppler width of the lasing transition. The authors adopted a single-laser pump-probe technique whereby a single laser pulse of microsecond duration is broken into saturating pumping radiation followed by weak probing radiation using a Pockel's cell optical switch. Preliminary measurements of rotational relaxation times in Hf at several tens of millitorr are presented for several P1 (J) transitions. The values obtained are in agreement with values obtained from Lorentz pressure-broadening data. At a high incident laser intensity, the absorbing transition of the Hf was saturated (bleached) and the later portions of the laser pulse passed without attenuation. In addition to this bleaching, transmitted pulses were obtained whereby the energy absorbed from the leading edge appeared later in the pulse. In portions of the transmitted pulse the energy actually exceeded that of the incident pulse and the net energy loss was anomalously small. At the highest laser intensities, damped oscillations were observed in the transmitted output. These anomalies are believed the result of self-induced transparency and optical nutations, respectively. (auth)

16391 (AD−782226) CO_2 MHD LASER: ANALYSIS, DESIGN, AND SHOCK TUNNEL EXPERIMENTS. Zauderer, B.; Tate, E.; Marston, C. H. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). May 1974. Contract N00014-73-C-0243. 8p. (74-SD-221). NTIS $3.00.

MHD laser gain exceeding 0.2%/cm has been achieved in the GE/ONR shock tunnel using a mixture of 78% He, 18% Ar, and 4% CO_2 with either 1% Xe or 0.1% Cs added to the basic mixture for seeding. Long relaxation times and non-emitting electrodes required use of some external voltage augmentation to achieve the necessary plasma conditions in the available generator length. The MHD laser analysis, design of a channel based on that analysis, and experimental results to date are discussed. (auth)

16392 (AD−782303) LASER PHYSICS, QUANTUM OPTICS, NONEQUILIBRIUM STATISTICAL MECHANICS, AND ENERGY DETECTORS. Final Report. Scully, M. O. (Arizona Univ., Tucson (USA). Dept. of Physics). Jun 1974. 45p. (AFOSR-TR-74-0967). NTIS $3.25.

The report contains brief summaries of research conducted in various areas and abstracts of papers produced under the research program. The unifying concept of the work is non-equilibrium statistical mechanics. Research topics include basic laser theory, laser-phase transition analogy, x-ray lasers, experimental quantum optics, Josephson radiation and superconductivity, and coherent phenomena. (GRA)

16393 (AD−783264) CHEMICAL LASERS AND ULTRA-RAPID-SCAN INFRARED SPECTROSCOPIC STUDY OF TRANSIENT SPECIES. Final Report. Pimentel, G. C. (California Univ., Berkeley (USA). Dept. of Chemistry). Jul 1974. 20p. (AFOSR-TR−74-1232). NTIS $3.00.

The unique capabilities of the Berkeley rapid-scan spectrometer have been applied to the study of a number of gaseous free radicals and the chemical laser frontier has been expanded. Most of the research effort has been directed toward the discovery of new chemical lasers, to the understanding of their operation, and to the extraction of reaction kinetic information from them. These kinetic studies reveal the temperature dependence of vibrational excitation of reaction products, information not presently accessible by other experimental techniques. (GRA)

16394 (AD−783297) MULTISTREAM COMPRESSIBLE FLOW COMPUTERIZED ANALYSIS. Cohen, L. S.; Flaherty, R. J. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). May 1974. Contract F44620-73-C-0031. 45p. (UARL-N−110997-2; AFOSR-TR−74-1282). NTIS $5.25.

A description of a Fortran 5 computer code for predicting the inviscid flow field produced by the interaction between several adjacent streams is presented. The flow field solution is based on the method of characteristics. To illustrate the use of the code, analytical results are used to develop optical property predictions for both the near and far fields for centrifugal aerowindow flow fields generated by four, two, and single nozzles. Further, a comparison is made between the four nozzle aerowindow far field optical predictions and experimental results. All instructions needed for execution of the computer program are contained within. (auth)

16395 (AD-783331) IR WINDOW STUDIES. Quarterly Technical Report No. 6. Kroger, F.; Marburger, J. H. (University of Southern California, Los Angeles (USA). Electronic Sciences Lab.). 15 Dec 1973. Contract F19628-72-C-0275. 89p. (USCEE-469). NTIS $4.00.

The theory of thermal lensing is reviewed and presented in modified form. A method to determine the contributions of various processes to multiphonon absorption is proposed. For GaAs, the lowest 10.6 micrometers absorptions found have a weak temperature dependence corresponding to theoretical predictions for multiphonon absorption. Layers of GaAs up to 2mm thick have been made by chemical vapor transport. The layers had inclusions, however, and the high 10.6 micrometers absorption probably result from these. A method for oxygen detection in Te-doped GaAs-Te was developed. In GaAs-Si, an oxygen content below the Si content cannot be determined. Diffuse streaks in the diffraction pattern of GaAs are attributed to thermal diffuse scattering of electrons at acoustic phonons. KBr with a 10.6 micrometers absorption of 0.0011/cm has been grown. A TEA laser for damage studies is being assembled. (auth)

16396 (AD-783379) NUMERICAL ANALYSIS OF UNSTEADY COMPRESSIBLE GAS DYNAMICS OF VARIED AREA CHANNELS: APPLIED TO GAS DYNAMIC LASER START. Gale, H. W. (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio (USA)). May 1974. 139p. (AFIT-CI-74-2). NTIS $10.00.

Thesis.

A characteristic method for one-dimensional unsteady flow with an indefinite number of discontinuities in a varied area channel was developed. The technique is an improvement of the Hartree technique. The technique has the desirable features of both the grid of characteristics method and the inverse specified solution point method. In the present method the solution points are determined by the intersection of right-running wave characteristics and specified constant time lines. The algorithm permits the formation of an indefinite number of right-running shocks and left-running shocks in the flow field. The shocks can dissipate, combine or depart from the channel. Shocks of opposite families can cross each other. Left running shocks can move upstream, downstream or remain stationary. A contact surface can be analyzed. A fluid particle can be followed in the flow. A numerical algorithm for computing internal flows of the type encountered in the start of gas dynamic lasers has been developed and programmed. Accuracy studies were conducted. (auth)

16397 (IPP-IV-75) VIBROTATIONAL ENERGY DISTRIBUTION AND RELAXATION PROCESSES IN THE HF LASER. Schmailzl, U. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). May 1974. 76p. (In German). Dep. NTIS (US Sales Only) $7.00.

The pulsed HF chemical laser model presented is partly based on a scheme developed before for describing the vibrational energy partitioning in chemical laser reactions with the aid of just one temperature-like parameter. The present approach extends earlier work by considering the initial, non-relaxed, rotational populations in a more explicit fashion and by studying the influence of various relaxation processes on the laser output. To this end two different initial product rotational energy distributions are tested. One of these is based on chemoluminescence measurements and classical trajectory calculations while the other one accounts for some other trajectory calculations and can be approximated by means of a simple statistical formula. Emphasis is placed on the competition between R-T relaxation which depletes and V-R, T relaxation which fills high rotational levels. In particular, an attempt is made to test the assumption that the feeding of high rotational levels, J, by V-R energy transfer might explain the appearance of laser transitions at J values higher than observed in the chemoluminescence measurements. The results shed some light on the controversy concerning the product rotational energy distribution in the reaction $F + H_2 \rightarrow HF + H$. The solutions to the complicated system of laser balance equation demonstrate the sensitivity of the laser output to the interplay between various kinetic processes present in every chemical laser system. (auth)

16398 (LA-5839-MS) MODELOCKED, MULTILINE PULSED CO_2 OSCILLATOR. Piltch, M. S. (Los Alamos Scientific Lab., N. Mex. (USA)). Jan 1975. Contract W-7405-eng-36. 3p. Dep. NTIS $4.00.

A modelocked, multiline oscillator was developed for use in laser-induced fusion investigations. A sodium chloride etalon provided the wavelength-dependent loss mechanism and an acoustooptic modulator was used for modelocking the laser. (auth)

16399 (SAND-73-0359) SATURABLE ABSORBERS. Jones, E. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 94p. Dep. NTIS $7.75.

A general review of saturable absorbers is presented, concerning their response to, and their effect upon, a laser pulse passing through them. Types of systems which are treated in detail are the fast-relaxing-two-level, three-level-monochromatic-frequency, three-level-two-frequency and two-photon systems. Finite relaxation effects upon the two-level system are also described. New results concerning focusing of the laser beam in single- and multiple-pass applications are presented, and it is concluded that this effect is to substantially increase the transmitted amount of laser pulse energy, but not to significantly increase the amount of pulse sharpening. The maximum amount of pulse narrowing that can be expected when relaxation time effects are taken into account is also discussed. Whenever possible, brief physical descriptions are presented of the processes studied. (auth)

16400 (SAND-74-0432) PROBES FOR DENSITY MEASUREMENTS OF F_2, HF, AND DF IN CONTINUOUSLY OPERATING CHEMICAL LASERS. Hill, R. A.; Hargis, P. J. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 48p. Dep. NTIS $5.50.

The applicability of electron-beam excited fluorescence and laser-Raman scattering to provide point measurements of the F_2 number density and population densities of $HF^*(v)$ or $DF^*(v)$ in continuous HF or DF lasers is examined. The Fabry-Perot interferometric "comb filter" should provide a method for measuring the densities of $HF^*(v)$ or $DF^*(v)$ where $v = 0$, 1, and perhaps 2 through the rotational Raman "hot bands." (auth)

16401 (SAND-74-5534) COMPUTER MODEL FOR THE $H_2 + F_2$ SUPER-RADIANT LASER. Moreno, J. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 10p. (CONF-750111-2). Dep. NTIS $4.00.

From 13th AIAA aerospace science meeting; Pasadena, California, USA (20 Jan 1975).

A computer model was developed to investigate the $H_2 + F_2$ super-radiant laser. The model is a complex system of space and time-dependent partial differential equations, governing the coupled chemistry and radiation. Rotational nonequilibrium is allowed. Numerical solutions are obtained using an implicit method-of-characteristics technique. The resulting computer code has moderate storage and time requirements despite the size of the problem. Operation of the $H_2 + F_2$ laser, both super-radiantly and driven by a cw oscillator, was studied. Results are presented showing the effects of gas mixture, initiation, incident radiation, geometry, and kinetic rates. (auth)

16402 (UCRL-75814) CALCULATION OF ROTATIONAL NONEQUILIBRIUM IN A PULSED HF LASER. Creighton, J. R.; Pearson, R. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Nov 1974. 22p. (CONF-741048-1). Dep. NTIS $4.25.

From 4th conference on chemistry and molecular lasers; St. Louis, Missouri, USA (Oct 1974).

Waveforms and population distributions were calculated by a numerical model and compared with experiment for an electric-discharge-initiated, pulsed $NF_3 + H_2$ chemical laser. The model treats each rotational state separately and allows rotational relaxation between adjacent states. Lasing is treated by equations equivalent to laser rate equations. Good agreement is obtained between calculated and experimental wave forms. Initially, population distributions are far from equilibrium. At the end of the pulse, they approach, but do not reach, Boltzmann equilibrium. (auth)

16403 DESIGN AND CONSTRUCTION OF A PULSED MOLECULAR NITROGEN LASER OF HIGH POWER. Elbern, A. W.; Rutt, H. N. (Federal Rio Grande Univ., Port Alegre, Brazil). Rev. Brasil. Tecnol.; 5: No. 1/2, 87-91(1974). (In Portuguese).

The design and construction of a pulsed molecular nitrogen laser is presented. The laser produces a peak power of 40 kW on the 3371Å superradiant line and was constructed using largely components purchased locally. (auth)

16404 EFFICIENCY OF LIQUID LUMINESCENCE FILTER IN A RUBY LASER. Levin, M. B.; Cherkasov, A. S.; Shirokov, V. I. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 5, 579-580(May 1974).

Translated from Opt. Spektrosk.; 36: No. 5, 987-989(May 1974).

Use of a luminescence filter based on α-naphthylphenyl-oxazole is considered for a ruby laser. It is established that use of the filter lowers the lasing threshold by 15%. The relative increase of lasing energy drops from twofold at 20% above threshold to 15% at twice the threshold energy. (auth)

16405 EXPERIMENTAL STUDY OF REACTIVE OSCILLATIONS IN THE DISCHARGE GAP OF A He–Ne LASER. Privalov, V. E.; Frikrikhov, S. A.; Shishkin, G. A. J. Opt. Soc. Amer.; 36: No. 5, 576-578(May 1974).

Translated from Opt. Spectrosk. 36: 5, 982-986(May 1974).

Oscillations on the falling part of the current-voltage characteristic of a discharge due to the reactances of the discharge and the external circuit have a considerable effect on power characteristics of a He–Ne laser. In order to reduce the secondary emission from the walls, half of the discharge tube was polished on the inside. The current-voltage characteristics when the polished part is next to the cathode and the anode are different. The oscillation parameters and the power characteristics of the laser change. (auth)

16406 SINGLE-HETEROSTRUCTURE PbS$_{1-x}$Se$_x$ DIODE LASERS. Sleger, K. J.; McLane, G. F.; Strom, U.; Bishop, S. G.; Mitchell, D. L. (Naval Research Lab., Washington, DC). J. Appl. Phys.; 45: No. 11, 5069-5071(Nov 1974).

PbS$_{1-x}$Se$_x$ single-heterostructure diode lasers have been fabricated using a 300°C vacuum deposition process to grow layers of p- or n-PbS$_{0.72}$Se$_{0.28}$ onto n-PbS$_{0.78}$Se$_{0.22}$ bulk substrates. At 12°K, laser emission occurs at 4.98 μm in the grown Pb$_{0.72}$Se$_{0.28}$ layer. Maximum power outputs are on the order of 1 mW. The 0.20% lattice mismatch at the heterojunction does not impose serious limitations on laser performance. (auth)

16407 SIMULTANEOUS TWO-WAVELENGTH OUTPUT FROM MULTIPLE-DYE PULSED TUNABLE DYE LASERS. Hilborn, R. C.; Brayman, H. C. (Oberlin Coll., OH). J. Appl. Phys.; 45: No. 11, 4912-4914(Nov 1974).

The observation of simultaneous two-wavelength output from nitrogen-laser-pumped multiple-dye lasers is reported. Rhodamine 6G-cresyl violet mixtures and coumarin-rhodamine 6G mixtures were studied. An analysis of the spatial distribution and time dependence of the two wavelengths indicates that in the range of dye concentrations used, radiative transfer is the dominant excitation transfer process. (auth)

16408 FACTORS INFLUENCING THE RELATIVE FREQUENCY STABILITY OF He–Ne LASER STRUCTURES. Hochuli, U. E.; Haldemann, P.; Li, H. A. (Univ. of Maryland, College Park). Rev. Sci. Instrum.; 45: No. 11, 1378-1381(Nov 1974).

6328 Å He–Ne laser structures, made from ultralow expansion materials, suspended in temperature- and pressure-controlled chambers, have shown drift rates in excess of +5 MHz/day. The same structure, evacuated and used as passive Fabry–Perot resonators, suspended in the previous now evacuated chambers, still show a drift rate of the order of +2 MHz/day. Computer simulated mirror model aging shows that relatively large changes of the dielectric constants of the mirror coatings are needed to explain the measured drift. It is felt that the dimensional stability of the materials and the properties of the optical contacts used, as well as the behavior of the dielectric mirrors, have to be more carefully investigated. (auth)

16409 BEHAVIOR OF COMMERCIAL LASER GLASSES ON GAMMA IRRADIATION. Buzhinskii, I. M.; Avakyants, L. I.; Surkova, V. F. Zh. Prikl. Spektrosk.; 21: No. 5, 923-925(Nov 1974). (In Russian).

The behavior of three basic brands of commercial laser glasses under gamma irradiation is considered. Generation and spectral characteristics before and after irradiation were investigated. The regularity in change of generation efficiency was determined as a function of the value of the inactive absorption induced by gamma radiation. Thermal and light annealing of the irradiated glasses was carried out. (tr-SJR)

16410 EFFECT OF RESONATOR MISADJUSTMENT ON THE PARAMETERS OF A ZEEMAN LASER. Adamson, N. A.; Bronnikova, L. K.; Fomin, Yu. A. Zh. Prikl. Spektrosk.; 21: No. 5, 920-922(Nov 1974). (In Russian).

As a result of heating the body of a laser, misadjustment of the resonator mirrors of the laser takes place, and this behavior leads to a decrease in power and a change in beat frequency of a He-N$_e$ gas laser on imposing a longitudinal magnetic field. Theoretical calculations were made and experimental measurements were carried out on the dependence of laser intensity and beat frequency of the circular components on changing the angle of resonator misadjustment. The results are presented in the form of graphs from which it follows that a sharp change in intensity is observed on insignificant pumping. With a great deal of pumping the intensity is less critical to misadjustment. The beat frequency increases sharply with an increase in pumping. A plot of the experimental curves at small angles of misadjustment is close to parabolic, and this behavior agrees well with the theoretically calculated curve. (tr-SJR)

16411 DYNAMICS OF A NEODYMIUM LASER IN GLASS WITH SPHERICAL MIRRORS ON SMOOTHING OUT THE SPACIAL INVERSION INHOMOGENEITY. Antsiferov, V. V.; Derzhi, N. M.; Folin, K. G. Zh. Prikl. Spektrosk.; 21: No. 5, 917-919 (Nov 1974). (In Russian).

On removing the spacial inversion inhomogeneity in a neodymium laser with spherical mirrors by the method of compensated phase modulation a quasistationary generation is obtained over a wide range of change in resonator parameters. A number of generation features are noted in neodymium lasers as compared with ruby lasers, which are caused by the greater optical homogeneity of glass rods and by the inhomogeneity in the spectral amplification of glasses with neodymium. (tr-SJR)

16412 OPTIMAL PARAMETERS OF A LASER ON A SOLUTION OF RHODAMINE 6 Zh IN ETHYL ALCOHOL WITH A GENERATION ENERGY APPROX. 100 JOULES. Baltakov, F. N.; Barikhin, B. A.; Sukhanov, L. V. Zh. Prikl. Spektrosk.; 21: No. 5, 914-916(Nov 1974). (In Russian).

A report is given on optimizing the energy and generation efficiency of a laser based on an ethyl alcohol solution of rhodamine 6 zh with an emission energy at a pulse of ~100 J on pumping with a pulse coaxial lamp according to dye concentration, resonator parameters and spectral composition of the pumping radiation. Maximum values of the energy and generation efficiency are attained for concentrations of rhodamine 6 zh from 2.2×10^{-5} to 3.3×10^{-5} moles/l in a resonator with mirrors having reflection coefficients of 99.5 and 8.5% with a cutoff in the ultraviolet region of the pumping radiation spectrum shorter than 230 nm. Deviations from these conditions lead to a sharp decrease in energy and efficiency of radiation that is generated. (tr-SJR)

16413 MONOLITHICALLY INTEGRATED AlGaAs DOUBLE HETEROSTRUCTURE OPTICAL COMPONENTS. Reinhart, F. K.; Logan, R. A. (Bell Labs., Murray Hill, NJ). Appl. Phys. Lett.; 25: No. 10, 622-624(15 Nov 1974).

Double heterostructure waveguides with contiguous regions of varying composition and dimension in the guiding layer have been grown by a modification of conventional liquid-phase epitaxial growth procedures. This permits integration of active (lasers) and passive (modulators) optical components. Modulation of the laser intensity and envelope spectrum have been observed with a reverse bias applied to an intracavity modulator section. Low-threshold lasers have been fabricated with far-field radiation angles reduced by close to a factor of 3 over those in conventionally grown lasers. (auth)

16414 STARK CELL STABILIZATION OF CO$_2$ LASER. Nussmeier, T. A.; Abrams, R. L. (Hughes Research Labs., Malibu, CA). Appl. Phys. Lett.; 25: No. 10, 615-617(15 Nov 1974).

A technique is demonstrated for locking of a GHz tunable waveguide CO$_2$ laser to a voltage programmable absorption line in NH$_2$D. Precision frequency control is demonstrated over the tuning range of the laser and long-term frequency stability of better than ±100 kHz is demonstrated. The advantages of the present technique are that no frequency modulation of the laser is required to generate an error signal and the laser frequency is determined by a linear relationship to the Stark cell voltage. (auth)

16415 ROOM-TEMPERATURE HETEROJUNCTION LASER DIODES FROM VAPOR-GROWN In$_{1-x}$Ga$_x$P/GaAs STRUCTURES. Nuese, C. J.; Ettenberg, M.; Olsen, G. H. (RCA Labs., Princeton, NJ). Appl. Phys. Lett.; 25: No. 10, 612-614(15 Nov 1974).

Vapor-grown epitaxial structures of In$_{0.5}$Ga$_{0.5}$P/GaAs have yielded heterojunction laser diodes with room-temperature threshold current densities as low as 8000 Å/cm^2 for a 2.5-μm GaAs laser cavity width. Differential external quantum efficiencies as high as 30% have been attained. Measurements suggest the existence of internally "trapped" laser modes due to the large refractive-index discontinuity at the In$_{0.5}$Ga$_{0.5}$P-GaAs interfaces. (auth)

16416 BROADENING COEFFICIENTS FOR THE P(20) CO$_2$ LASER TRANSITION. Abrams, R. L. (Hughes Research Labs., Malibu, CA). Appl. Phys. Lett.; 25: No. 10, 609-611(15 Nov 1974).

Accurate line-shape and linewidth measurements have been made on the P(20) 10.6-μm CO$_2$ laser transition using optoacoustic spectroscopy and a tunable waveguide CO$_2$ laser. The absorption line shape is shown to be accurately represented by a

Voigt line shape and the measured broadening coefficients are $\gamma_{CO_2} = 7.61 \pm 0.10$, $\gamma_{N_2} = 5.58 \pm 0.20$, and $\gamma_{He} = 4.88 \pm 0.18$ MHz/torr, all measured at 298°K. (auth)

16417 TOWARD A ZERO SMALL-SIGNAL GAIN LASER POWER AMPLIFIER. Schappert, G. T.; Stark, E. E. Jr. (Los Alamos Scientific Lab., NM). Appl. Phys. Lett.; 25: No. 10, 602-605(15 Nov 1974).

It is shown that small-signal gain reduction in a CO_2 laser power amplifier can be achieved by adding to the gain medium deuterated ammonia as a saturable absorber. The saturation energy, and effects of NH_2D on the amplifier kinetics and energy extraction were also investigated. (auth)

16418 ACID TREATMENT FOR RAISING THE SURFACE DAMAGE THRESHOLD OF LASER GLASS. Ringlien, J. A.; Boling, N. L.; Dube, G. (Owens-Illinois Technical Center, Toledo). Appl. Phys. Lett.; 25: No. 10, 598-600(15 Nov 1974).

Results of damage experiments on superpolished glass surfaces are briefly presented. It is found that polishing of glass beyond what is readily obtained by conventional polishing is not effective in increasing the damage threshold. Removal of contaminants is apparently more important, and this can be accomplished by treatment with hot nitric acid or water. The threshold can be increased by as much as a factor of 3 by using hot nitric acid. The effectiveness of the acid treatment is time dependent and the increase in effectiveness fits a diffusion model. (auth)

16419 C_3F_7I PHOTODISSOCIATION LASER INITIATED BY A CO_2-LASER-PRODUCED PLASMA. Silfvast, W. T.; Szeto, L. H.; Wood, O. R. II. (Bell Telephone Labs., Holmdel, NJ). Appl. Phys. Lett.; 25: No. 10, 593-595(15 Nov 1974).

Ultraviolet radiation from a CO_2-laser-produced plasma in xenon has been used to obtain laser action at 1.315 μm by photodissociation of C_3F_7I. The relative laser output and potential efficiency of this laser excitation technique is compared to that achieved using electrical flashlamp pumping. (auth)

16420 SHORT CO_2 LASER PULSE GENERATION BY OPTICAL FREE INDUCTION DECAY. Yablonovitch, E. (Bell Telephone Labs., Holmdel, NJ); Goldhar, J. Appl. Phys. Lett.; 25: No. 10, 580-582(15 Nov 1974).

Short CO_2 laser pulses, adjustable in the range between 0.1 and 0.5 nsec, have been produced by a new pulse-shaping technique. A laser breakdown spark is the active switching element, but the pulse is actually generated by optical free induction decay in a passive linear medium. This approach features simplicity, fast rise time, high contrast ratio, unity switching efficiency, and is suitable as the input to high-power amplifier stages. (auth)

16421 ANALYSIS OF OPTICALLY PUMPED CO_2 LASER. Pirkle, J.C. Jr. (School of Medicine, Baltimore 21205); Sigillito, V.G. Appl. Opt. 13: No. 12, 2799-2807 (Dec 1974).

The operating characteristics of an optically pumped CO_2 laser are analyzed by a mathematical procedure that treats the transport of the pumping radiation according to the method of Milne. Simple expressions are obtained for laser power output and efficiency vs such operating parameters as initial pressure, species concentrations, output mirror transmittance, linewidth of the pumping radiation, and cavity dimensions. Optimum power output efficiencies appear to be comparable with those of electrical discharge and chemically pumped CO_2 lasers. (auth)

16422 PULSED ION LASERS EXCITED BY THE PINCH EFFECT. Katzenstein, J. (Quantrad Corporation, 139 Illinois Street, El Segundo, California 98245); Lovberg, R.H. Appl. Phys. Lett. 26: No. 3, 113-115 (1 Feb 1975).

Previous experimental work has demonstrated strong laser action on the ionized lines of argon and xenon in pinch discharges in these gases. This laser action is correlated in time with the minimum contraction of the discharge. The laser output power, however, was found to saturate with bank voltage, and to be maximized at a critical initial filling pressure. These phenomena, obtained empirically in the initial work, can be shown to be the consequences of a generalized impedance matching problem, and hence correspond to the optimization of the transfer of stored bank energy to the pinched plasma. Thus, rational scaling laws can be derived for this type of laser. (auth)

16423 INFRARED NITROGEN LASER USING A TRANSVERSE DISCHARGE. Tarasenko, V.F.; Bychkov, Yu.I. (Institute of Atmospheric Optics, Siberian Branch, Academy of Sciences of the USSR, Tomsk). Sov. Phys.—Tech. Phys. 19: No. 5, 693-693 (Nov 1974).

Laser action is obtained in molecular nitrogen on the First Positive system using transverse excitation. The optimum pressure is 33 torr and the output pulse is delayed with respect to the exciting pulse by less than 10 nsec. Certain features of transverse excitation are considered. (auth)

16424 COLLISION GAS–DISCHARGE LASER UTILIZING EUROPIUM VAPOR. I. OBSERVATION OF SELF–TERMINATING OSCILLATIONS AND TRANSITION FROM CYCLIC TO QUASICONTINUOUS OPERATION. Bokhan, P.A.; Klimkin, V.M.; Prokop'ev, V.E. (Institute of the Optics of the Atmosphere, USSR Academy of Sciences). Sov. J. Quantum Electron. 4: No. 6, 752-754 (Dec 1974).

The requirements which active media of cw atomic collision lasers must satisfy were formulated on the basis of an analysis of earlier investigations of other workers and the present authors. It was concluded that the promising media were elements with a partly filled 4f shell (rare—earth metals). Several stimulated emission lines of ionized europium were observed in the visible and near infrared range. The majority of these lines was obtained at anomalously high (above 200 mm Hg) helium pressures. The principal properties of laser radiation were determined. A continuous transition from self—terminating oscillation to quasicontinuous emission was achieved for one of the lines by increasing helium pressure. (auth)

16425 COLLISION GAS–DISCHARGE LASER UTILIZING EUROPIUM VAPOR. II. INVERSION POPULATION MECHANISM. Bokhan, P.A.; Klimkin, V.M.; Prokop'ev, V.E. (Institute of the Optics of the Atmosphere, USSR Academy of Sciences). Sov. J. Quantum Electron. 4: No. 6, 755-757 (Dec 1974).

An analysis was made of the excitation mechanisms of the $^{7,9}P$ upper levels of the europium ion and of the relaxation of the lower $^7D^0$ levels. It was found that the upper laser states of the ^9P type were excited by collisions of europium atoms in the ground state with electrons. The ^7P levels were excited by collisions of europium ions with helium atoms. The lower levels were deactivated by collisions of europium ions with helium atoms. The factors limiting the output power were considered. A specific output power of 3 W/cm³ was obtained for a tube of 0.7—cm diameter operating under quasicontinuous conditions with an efficiency of 0.6%. (auth)

16426 AMPLIFICATION IN γ–RAY LASER. Il'inskii, Y.A.; Namiot, V.A. (M. V. Lomonosov State University). Sov. J. Quantum Electron. 4: No. 7, 890-891 (Jan 1975).

A theoretical analysis is made of the amplification in a γ—ray laser excited with a radiofrequency signal. It is shown that an additional splitting of a line does not reduce the gain. (auth)

16427 ASPECTS OF THE FABRICATION AND PROPERTIES OF AlAs—GaAs HETEROJUNCTION LASERS. Alferov, Z.I.; Andreev, V.M.; Klepikova, N.V.; Kolyshkin, V.I.; Konnikov, S.G.; Larionov, V.R.; Portnoi, E.L.; Shelovanova, G.N. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.—Semicond. 8: No. 7, 826-829 (Jan 1975).

A study was made of some aspects of the fabrication of AlAs—GaAs multilayer heterojunction lasers and of the influence of the heterostructure parameters on the spectral, threshold, and power characteristics of the lasers at 300°K. The threshold current density of the lasers with the active region $d=0.4-1.4\ \mu$ thick was $j_{th}/d = 3.6 \mathrm{kA \cdot cm^{-2} \cdot \mu^{-1}}$. The maximum specific power emerging through one resonator face was $\sim 3 \cdot 10^6$ W/cm² (in the form of pulses of $\tau_p = 10^{-7}$ sec duration). These results were obtained for the samples in which the laser action was homogeneous and which were characterized by a differential efficiency $\eta_d \simeq 70\%$. An investigation was also made of multilayer lasers with two narrow—gap active regions. (auth)

16428 TWO-PHOTON ABSORPTION IN CdS BY LOW POWER CW LASER. Cornolti, F.; Fornaca, G.; Giulietti, A.; Vselli, M. (Consiglio Nazionale delle Ricerche, Pisa, Italy). J. Lumin.; 8: No. 6, 462-470(Apr 1974).

The two-photon induced luminescence in CdS crystals by using a low-power cw laser (5 mW) was studied. The possibility given by the electron-pulse-counting technique to detect weak optical signals is briefly discussed. This technique enables the luminescence spectra (which show two bands at 2.4 and 2.0 eV) and the dependence of the luminescence intensity on the laser power to be studied. The discussion of the experimental results makes it clear that the level responsible for the red emission is partially saturated at a laser intensity of 10^{23} photon/cm² s. (auth)

16429 GaAs–$Ga_{1-x}Al_xAs$ BURIED-HETEROSTRUCTURE INJECTION LASERS. Tsukada, T. (Hitachi, Ltd., Tokyo). J. Appl. Phys.; 45: No. 11, 4899-4905(Nov 1974).

Buried-heterostructure injection lasers which have the filamentary GaAs active regions completely surrounded by $Ga_{1-x}Al_xAs$ are proposed and have been successfully fabricated by using two-step liquid-phase-epitaxial techniques. The active regions of these lasers can be made extremely small and do not have dimensional unbalances encountered in conventional injection lasers. The threshold current has been reduced to a value as low as 15 mA by applying current-confining geometry to this laser. A study of optical characteristics has revealed such improvements over ordinary lasers as Gaussian beam profile, fundamental mode (TE_{00}) operation, mode reproducibility, and mode stability. Due to the superior thermal properties of these lasers cw operation was easily obtained. (auth)

16430 PROPOSED CO_2-LASER STANDING-WAVE INTRACAVITY COUPLING MODULATOR FOR A 53-GHz CW SIGNAL. Bonek, E.; Schiffner, G.; Pisecker, R.; Kohl, F. (Technische Hochschule, Vienna). IEEE J. Quant. Electron.; QE-10: No. 2, 128-130(Feb 1974).

Tunable IR signals can be generated by the proposed arrangement comprising a CO_2 laser and a tunable millimeter-wave cavity coupling modulator. The position of the modulator within the laser cavity was found to be critical but can be optimized. Under optimum conditions, 2.5 mW (8.0 mW) can be expected in each sideband with 1-W drive power for GaAs (CdTe) crystals at bandwidths of 21 GHz (10 GHz). The design principle of the millimeter-wave cavity was verified in a scaled-model experiment. (auth)

16431 CW LASER OPERATION OF N,N'-di-β-PHENYLETHYLRHODAMINE. Riseberg, L. A.; Lempicki, A.; Samelson, H.; Walters, R. M. (GTE Laboratories Inc., Waltham, MA). IEEE J. Quant. Electron.; QE-10: No. 2, 132-133(Feb 1974).

CW laser action is reported for N,N'-di-β-phenylethylrhodamine in an ethanol–water binary solution. Performance appears to be competitive with rhodamine 6G, with an output wavelength and tuning curve slightly to the blue relative to rhodamine 6G. (auth)

16432 THEORY OF OPTICAL GAIN AND THRESHOLD PROPERTIES OF SEMICONDUCTOR LASERS. Aleksanian, A. G.; Poluektov, I. A.; Popov, Yu. M. (Lebedev Inst. of Physics, Moscow). IEEE J. Quant. Electron.; QE-10: No. 3, 297-305(Mar 1974).

The theory of optical gain in highly doped semiconductors employed for semiconductor lasers is developed based on the Green function approach. With the help of the analytical expression obtained for optical gain, the threshold properties of semiconductor lasers and their dependence on concentration of doping impurities and on temperature are studied. Results of numerical calculations of threshold characteristics for the most interesting cases are presented. (auth)

16433 OBSERVATION OF DIFFUSION AS AN EFFECTIVE VIBRATIONAL RELAXATION RATE IN CO_2. Granek, H. (Massachusetts Inst. of Tech., Lexington). IEEE J. Quant. Electron.; QE-10: No. 3, 320-325(Mar 1974).

A differential absorption signal of 10.6-μ radiation by a CO_2 cell in the alternating presence and absence of a partially saturating beam on a different transition is observed as a function of increasing pressure of helium. The linear increase with pressure at low pressures is explained as a result of diffusion acting as a strong effective vibration relaxation rate. The behavior as a function over the entire observed pressure range is well described by combining simple collision and diffusion effects. (auth)

16434 INTENSE ELECTRON-BEAM INITIATION OF A HIGH-ENERGY HYDROGEN FLUORIDE (HF) LASER. Gerber, R. A.; Patterson, E. L. (Sandia Labs., Albuquerque, NM). IEEE J. Quant. Electron.; QE-10: No. 3, 333-337(Mar 1974).

A superradiant hydrogen fluoride (HF) laser is described in which an intense electron beam, propagating in a SF_6 and C_2H_6 mixture, is used to initiate chemical reactions that produce vibrationally excited HF molecules. The variation of laser energy as a function of SF_6 pressure for fixed composition and as a function of composition at a fixed SF_6 pressure has been investigated. These experimental parametric curves are discussed in terms of the relevant physics. The maximum laser energy of 228 J in a 55-ns full-width-at-half-maximum (FWHM) pulse was obtained with a mixture of 400-torr SF_6 and 40-torr C_2H_6. Measured efficiency for converting deposited beam energy to laser energy propagating in the forward direction was as large as 8%. (auth)

16435 NONLINEAR-OPTICAL DEVICE CHARACTERISTICS OF GASEOUS SATURABLE ABSORBERS. Christensen, C. P.; Schwarz, S. E. (Univ. of California, Berkeley). IEEE J. Quant. Electron.; QE-10: No. 3, 338-346(Mar 1974).

Measurements have been made of the third-order nonlinear optical susceptibilities of gaseous infrared saturable absorbers. These coefficients are relevant to mode locking of infrared lasers such as CO_2. The measurements are in good agreement with a theory based on a four-level model of the absorber. Earlier mode-locking observations are interpreted in light of the new data. The value of the transition moment and some other parameters of SF_6 are deduced from the measurements. For SF_6 at p = 1 torr, the third-order nonlinear coefficient is in the range 1 to 10×10^{-23} $C \cdot m/V^3$, when interacting waves differ in frequency by less than the molecular collision frequency. It is that the average dipole transition moment for SF_6 near the P(16) or P(20) lines of CO_2 is approximately 0.1 to 0.2 Debye. The nonlinear coefficient of CH_3F is typically three orders of magnitude smaller than that of SF_6. (auth)

16436 LASER Q SWITCHING BY A PLZT SHUTTER. Landry, M. J. (Sandia Labs., Albuquerque, NM). IEEE J. Quant. Electron.; QE-10: No. 3, 356-358(Mar 1974).

The application of a polycrystalline ferroelectric ceramic $Pb_{1-x}La_x(Zr_yTi_z)_{1-(x/4)}O_3$ (called PLZT) electrooptic shutter is described for controlling the giant pulse emission of a ruby laser. The PLZT material had y = 65%, z = 35%, and the value of x was in the vicinity of 8%. Half-wave retardation switching was not possible with the PLZT shutter when 10-ns rise-time 70-ns-duration voltage pulses (fast Q switching) were applied. The increase insertion loss, due to less than half-wave retardation, resulted in laser pulsewidths that were wider and contained less energy than predicted by fast Q-switching theory. Since the PLZT material was damaged at relatively low power densities of between 5.6 to 8.5 MW/cm^2, respectively, its use is restricted to Q-switching small output power. (auth)

16437 GAIN OF HIGH-PRESSURE CO_2 LASERS. Chang, N. C.; Tavis, M. T. (Aerospace Corp., El Segundo, CA). IEEE J. Quant. Electron.; QE-10: No. 3, 372-375(Mar 1974).

Gain formulas are shown for the 10.4- and 9.4-μm CO_2 bands for the high-pressure broadening case to point out a new regime of operation for this laser. Computer-simulated results of this gain are presented as a function of wave number, with density equivalent pressure and population inversion ratio as parameters. The results show gain curves that suggest continuously tunable lasers over the entire 9.4- and 10.4-μm bands with no rotational structure. (auth)

16438 LASER-INDUCED ELECTRIC BREAKDOWN IN SOLIDS. Bloembergen, N. (Harvard Univ., Cambridge, MA). IEEE J. Quant. Electron.; QE-10: No. 3, 375-386(Mar 1974).

A review is given of recent experimental results on laser-induced electric breakdown in transparent optical solid materials. A fundamental breakdown threshold exists characteristic for each material. The threshold is determined by the same physical process as dc breakdown, namely, avalanche ionization. The dependence of the threshold on laser pulse duration and frequency is consistent with this process. The implication of this breakdown mechanism for laser bulk and surface damage to optical components is discussed. It also determines physical properties of self-focused filaments. (auth)

16439 HIGH PEAK POWER AND SHORT PULSES FROM A RING LASER MODE LOCKED BY INTERNAL MODULATION. Miyashita, T.; Ikenoue, J. (Kyoto Univ.). IEEE J. Quant. Electron.; QE-10: No. 3, 387-389(Mar 1974).

Mode-locked unidirectional traveling-wave oscillation of a He–Ne ring laser is theoretically shown to be possible by internal loss or phase modulation. It should have a higher peak power and shorter pulses than the conventional laser systems. (auth)

16440 HCl CHEMICAL LASING WITH HI AND CHLORO COMPOUNDS. Taylor, D.; Mayer, S. W.; Suchard, S. N. (Aerospace Corp., El Segundo, CA). IEEE J. Quant. Electron.; QE-10: No. 3, 389-390(Mar 1974).

HCl chemical laser action has been obtained from chloro compounds when HI was used as the source of H atoms. Laser action was produced on several ν = 3-2, 2-1, and 1-0 HCl transitions when initiated by transverse pulsed discharges in HI–He mixtures containing such chloro compounds as CCl_4, $CHCl_3$, and several Freons. Both HCl and HF lasing were observed when a Freon ($C_2Cl_2F_4$) containing F as well as Cl was used. The measured wavelengths for these HCl lasers correspond to excellent atmospheric windows for transmission of infrared radiation. No CHl lasing was obtained when HBr, H_2S, or H_2 were substituted for HI. (auth)

16441 Q SWITCHING AND MODE LOCKING THE Nd^{3+}-GLASS LASER WITH THE NICKEL DITHIENES. Magde, D.;

Bushaw, B. A.; Windsor, M. W. (Washington State Univ., Pullman). IEEE J. Quant. Electron.; QE-10: No. 3, 394(Mar 1974).

Measurement of the relaxation time for transient bleaching of solutions of bis-(4-dimethylaminodithiobenzil)-nickel (BDN) explains observed Q-switch and mode-locking behavior. A pronounced solvent effect permits varying relaxation time by a factor of 5 down to times short enough to be considered for mode locking in special circumstances. (auth)

16442 INFRARED LASER LINES IN NEUTRAL ATOMIC PHOSPHORUS. Fowles, G. R.; Zuryk, J. A.; Jensen, R. C. (Univ. of Utah, Salt Lake City). IEEE J. Quant. Electron.; QE-10: No. 3, 394-395(Mar 1974).

Laser oscillation in the near infrared has been found in pulsed discharges in phosphorus vapor. The laser transitions are assigned to the neutral phosphorus atom. (auth)

16443 INVESTIGATION OF MICROSECOND PULSE LASER GENERATION WITH THE NON-LINEAR ABSORBER. Baltrameyunas, R. A.; Vaitkus, Yu. Yu.; Veletskas, D. A. (Vilnyus State Univ., USSR). Liet. Fiz. Rinkinys; 14: No. 2, 335-344 (1974). (In Russian).

The basic properties of neodymium glass and ruby lasers with the tunable duration of the laser pulse were investigated. The increase of the laser pulse was achieved by inserting the nonlinear semiconductor crystals of CdS, CdSe, GaAs into the cavity. The duration of the laser pulse varied from 30 to 2500 ns. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 16480, 17409, 17644, 18052, and 18053.

16444 (JINR-P13-8233) SOME PROBLEMS OF OPTIMIZATION OF SUPERCONDUCTING QUANTUM INTERFEROMETERS. Vasil'ev, B. V.; Danilov, V. V.; Likharev, K. K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The problems of optimization of the output signal amplitude from a magnetometer, the signal characteristic slope, and the minimum of the magnetic flux observed are considered. A satisfactory agreement with experimental data was observed. The problems of the magnetometer application in the laboratory experiments are considered. (auth)

16445 "DIAMAGNETIC" (RESIDUAL) FIELD IN SUPERCONDUCTING MAGNETS. Duchateau, J. L. (CEN, Saclay, France). Particle Accel.; 6: No. 1, 7-17(1974). (In French).

Residual and diamagnetic field in superconducting magnets are caused, for a great part, by circulating currents, in superconducting filaments. This diamagnetic field affects the quality of field in superconducting magnets and gives an inhomogeneity problem at injection into a superconducting synchrotron. The theory of residual field in superconducting magnets with iron yoke is presented. The variations of diamagnetic field during a whole accelerator cycle are explained. At low fields, this diamagnetic field imposes its high undesirable multipole content, in the magnet; at higher fields the effects of this diamagnetic field disappear and the field homogeneity becomes better. The main problem is to know at which point of the cycle injection would be possible in good homogeneity conditions. As an example, the variations of the undesirable sextupole content of the field are computed for the dipole "Moby" under construction at SACLAY. A comparison of the computed values with experimental results is also given for the SACLAY quadrupole "OGA". Finally, methods to reduce the effects of diamagnetic field in superconducting magnets are discussed. (auth)

16446 CURRENTS, VOLTAGE, AND LOSSES IN A SUPERCONDUCTIVE TOPOLOGICAL GENERATOR. Kazovskii, E. Ya.; Antonov, Yu. F. Izv. Akad. Nauk SSSR, Energ. Transp.; No. 1, 97-104(1974). (In Russian).

Based on a refined equivalent circuit of a topological generator (magnetic flux pump), the authors formulate and solve a system of equations for the currents in the pump circuits, derive expressions for the current increment in the load and the average voltage across the terminals of the device, and determine losses in the normal zone and in the zone of the mixed state. The resultant expressions are applicable to topological generators with superconductive stator of any form, and in particular for cylinder and disk stators. (JPRS)

16447 LOW TEMPERATURE PHYSICS: LT 13 VOLUME 4. Electronic Properties, Instrumentation, and Measurement. 13th International Conference Held at Boulder, Colorado, August 21-25, 1972. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corporation (1974). 694p. (CONF-720833-(P4)). $35.00.

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972).

Separate abstracts were prepared for 42 of the 112 papers presented. The remaining 69 papers were not within the scope of NSA. (WHK)

For abstracts of individual papers see: 16448-16465, 16480, 17353-17372, 17550, 18052, and 18053.

16448 NEW TECHNIQUES IN REFRIGERATION AND THERMOMETRY. Wheatley, J. C. (Univ. of California, San Diego, La Jolla). pp 455-464 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Topics discussed include (1) pressure sensing via capacitors, (2) application of superconducting devices to measurement, (3) thermal contact via magnetic coupling to ^{3}He, (4) the adiabatic compression device, (5) adiabatic demagnetization of CMN/CDP, and (6) the dilution refrigerator. (WHK)

16449 CRYOGENIC METROLOGY. Taylor, B. N. (National Bureau of Standards, Washington, DC). pp 465-482 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The applications of cryogenic techniques and phenomena to metrology are reviewed. The following topics are discussed. (1) Past applications: a very brief summary of some past applications of cryogenics to metrology, pre-1962 (the year 1962 is chosen as the dividing line since cryogenic metrology has only come of age during the last decade with the discovery of the Josephson effects). (2) Present applications. (a) Fundamental constants: 2e/h, hN, H/m$_e$, and c, where e is the electron charge, h is the Planck constant, N is the Avogadro constant, m$_e$ is the free-electron rest mass, and c is the speed of light in vacuum; (b) Basic measurements and standards: volt maintenance, thermometry, time and frequency, and rf attenuation; (c) Novel instrumentation: A selection of specific state-of-the-art and highly promising instruments requiring cryogenics for their operation. (3) Comments on the future of cryogenic metrology. (66 references) (WHK)

16450 MACROSCOPIC QUANTUM DEVICES. Clarke, J. (Univ. of California, Berkeley). pp 483 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The operation of dc and rf SQUID devices and their use for measuring magnetic fields, magnetic field gradients, and magnetic susceptibilities are briefly described. (WHK)

16451 TEMPERATURE SCALE DEFINED BY ^{60}Co γ-RAY ANISOTROPY AND NOISE THERMOMETRY. Marshak, H.; Soulen, R. J. Jr. (National Bureau of Standards, Washington, DC). pp 498-502 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A γ-ray anisotropy thermometer (^{60}Co in hcp ^{59}Co single crystal) was evaluated in the m°K range, and the results are compared with those of a Josephson junction noise thermometer. (WHK)

16452 RELATIONSHIP BETWEEN NOISE TEMPERATURES AND POWDERED CMN MAGNETIC TEMPERATURES: APPLICATION TO THE PROPERTIES OF ^{3}He. Webb, R. A.; Giffard, R. P.; Wheatley, J. C. (Univ. of California, San Diego, La Jolla). pp 517-521 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The results of a detailed and systematic investigation of Johnson noise thermometry using an rf-biased point-contact superconducting device (SQUID) to sense the Johnson noise currents from a resistor are reported. The noise resistor was placed in the very low-temperature part of the apparatus and connected via superconducting leads to a superconducting coil located in one hole of a two-hole symmetric SQUID at 4.2°K. (WHK)

16453 MAGNETOCHEMICAL MEASUREMENTS OF BIOCHEMICAL COMPOUNDS WITH A SUPERCONDUCTING MAGNETOMETER. Cerdonio, M.; Wang, R. H.; Rossman, G. R.; Mercereau, J. E. (California Inst. of Tech., Pasadena). pp 525-534 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A new experimental instrument for measurements of temperature-dependent magnetic susceptibility over the temperature range of 2°K to room temperature has been developed. The high sensitivity and reproducibility of the superconducting magnetometer open a new realm of magnetic measurements on weakly magnetic materials. Already data have been obtained on biochemical compounds of unknown coordination environment, some of which were unmeasurable with previous techniques. Unlike the conventional techniques, this instrument shows great promise for further improvement in sensitivity, response time, and convenience. (auth)

16454 SUPERCONDUCTING-CAVITY-STABILIZED OSCILLATORS OF 10^{-14} STABILITY. Stein, S. R.; Turneaure, J. P. (Stanford Univ., CA). pp 535-541 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The use of superconducting cavities to stabilize klystrons and Gunn effect oscillators to produce fractional frequency stabilities of $10^{-12}-10^{-13}$ has been recently reported. Progress has been made in developing this technique and an order of magnitude improvement in short-term stability for stabilized Gunn effect oscillators was achieved at 8.6 GHz. The best measured value for the standard deviation of the fractional frequency fluctuations $\sigma_y(N = 2, \tau = 10^2 \text{ sec})$ is 1.5×10^{-14}. There has also been two orders of magnitude improvement in long-term stability, with a measured average fractional frequency drift of 1.6×10^{-14} hr^{-1} during a 32-hr interval. The most immediate interest in these oscillators, other than the development of the oscillators themselves, is to attempt a measurement of the temporal change in the fine structure constant. There is also interest in the development of a compact clock for the measurement of various time effects related to general relativity. Some are interested in such oscillators to make measurements of gravitational radiation, to improve atomic time standards, such as the cesium atomic clock and the proposed hydrogen storage beam atomic clock, and to provide an ultrastable X-band source for infrared-microwave frequency synthesis between the frequency of methane and the frequency of cesium. Research progress is outlined. (WHK)

16455 RELATIONSHIP OF JOSEPHSON JUNCTIONS TO A UNIFIED STANDARD OF LENGTH AND TIME. McDonald, D. G. Risley, A. S.; Cupp, J. D. (National Bureau of Standards, Boulder, CO). pp 542-549 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Work is being done on infrared frequency synthesis using Josephson junctions with a goal of substantially simplifying existing techniques in this field and thereby contributing to the possible realization of a unified standard. To describe the technical context of this work, saturated absorption spectroscopy, developments in infrared frequency synthesis, and their relationship to standards of time and length are discussed. (WHK)

16456 STATIC SUSCEPTIBILITY OF BIOLOGICAL MOLECULES AND SQUID DETECTION OF NMR. Day, E. P. (Stanford Univ., CA). pp 550-554 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A static susceptibility apparatus capable of detecting changes of 10^{-10} cgs in a 0.25-cm^3 room-temperature sample has been developed, using the technology of superconductivity. The instrument has been used to detect nuclear magnetic resonance by following rf-induced changes in the longitudinal nuclear magnetization. It has also been used to search for changes in the diamagnetic susceptibility of biological molecules as they undergo conformational changes. The static susceptibility instrument is discussed first, followed by a discussion of the nuclear magnetic resonance experiment and a discussion of the search for changes in the diamagnetism of biological macromolecules. (WHK)

16457 LARGE-DIAMETER SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES FOR A MEASUREMENT OF H/M. Falco, C. M.; Parker, W. H. (Univ. of California, Irvine). pp 563-567 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Progress made toward a precision measurement of the fundamental physical constant h/m, where m is the rest mass of the free-electron, using the macroscopic phase coherence of superconductors is reported. Previous measurements using a 2-mm diameter SQUID demonstrated the possibility of using a rotating ring to measure h/m. A measurement with an accuracy of a few parts per million will require SQUIDs of much greater diameter. Work toward developing and studying the behavior of large-diameter SQUID devices is reported. (WHK)

16458 FREQUENCY PULLING IN JOSEPHSON JUNCTIONS. Ulrich, B. T. (Univ. of Texas, Austin). pp 568-571 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The voltage V across a Josephson junction and the current I through the junction obey the equations $V = (\hbar/2e)d\varphi/dt$ and $I = I_0 \sin \varphi$, where φ is the quantum phase difference across the junction. When $V \neq 0$ an oscillating current flows in the junction, and this current emits electromagnetic radiation. The time average of the voltage equation $\langle V\rangle = (\hbar/2e)\ \langle d\varphi/dt\rangle = (\hbar/2e)\ \langle\omega\rangle$ relates the average voltage across the junction to the average time derivative of the phase. An experiment in which a junction coupled to a microwave cavity locks to a mode of the cavity and emits most of its radiation at the cavity resonant frequency ω_c, which may differ from $\langle\omega\rangle$ by as much as 1%, is described. The "frequency pulling" effect described refers to the observation that the frequency of the emitted radiation differs from the frequency $\langle\omega\rangle$ that would be determined by $\langle V\rangle$. This result is interpreted in terms of a parametric relaxation mechanism in which the phase difference across the junction progresses at the cavity frequency ω_c most of the time and then periodically relaxes rapidly to maintain the average angular frequency, $\langle d\varphi/dt\rangle = (2e/\hbar)\ \langle V\rangle$, with the relaxation taking place rapidly compared to the time during which the phase progresses at the cavity frequency. During the entire process the detailed voltage–phase relationship $V = (\hbar/2e)d\varphi/dt$ is valid at all times. (WHK)

16459 FLUX PERIOD OF JOSEPHSON JUNCTION INTERFEROMETERS. Stuehm, D. L.; Wilmsen, C. W. (Colorado State Univ., Fort Collins). pp 572-574 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The use of Josephson junction interferometers for the measurement of very small magnetic fields and the absolute value of magnetic fields depends, respectively, on accurately knowing the flux period of the interference pattern and the location of zero applied field. In addition, the shape of the interference pattern becomes complex when multiple-junction interferometers are used. A qualitative description of the flux period of two-junction interferometers and numerically computed interference patterns for three-junction interferometers are presented. (WHK)

16460 MAGNETIC FIELD AND Q DEPENDENCE OF SELF-INDUCED CURRENT PEAKS IN RESONANT JOSEPHSON TUNNEL JUNCTIONS. Schwidtal, K.; Smiley, C. F. (Electronic Tech. and Devices Lab., Fort Monmouth, NJ). pp 575-579 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The most general theory of the self-induced current "steps" in the dc I–V characteristics of resonant Josephson tunnel junctions reported thus far has been developed by Kulik. In contrast to previous theories, Kulik makes no restrictive assumptions other than that the junction length L is small with respect to the Josephson penetration depth λ_J. This is the very same assumption made in deriving the Fraunhofer diffraction equation for the magnetic field dependence of the maximum dc Josephson current I_0. It is therefore assumed that Kulik's theory is applicable whenever the measured $I_0(H_e)$ curve can be described by the Fraunhofer diffraction equation, which is practically the case for all rectangular junctions with a uniform oxide barrier layer, and $L/\lambda_J \leq 2$. No systematic experimental test of Kulik's theory has previously been made. This may be due to the fact that a quantitative comparison of measured $I_n(H_e)$ curves with the theory requires Q_n to be known, which it is not. But one can look at the problem the other way around. Kulik's theory allows one to obtain Q_n data from measured $I_n(H_e)$ curves; this is much easier to do than to measure $Q_n = \omega_n/\Delta\omega$ directly. It then remains to show that the resulting $Q_n(n)$ functions are reasonable. The experiment was conducted and it is concluded that the measured magnetic field dependence of I_n is in very good agreement with Kulik's theory. (WHK)

16461 PARAMETRIC OSCILLATIONS IN SUPERCONDUCTING DOUBLE POINT-CONTACT STRUCTURES. Ulrich, B. T. (Ecole Normale Superieure, Paris). pp 580-584 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Parametric phase slip oscillations have been observed in double point-contact Josephson junctions, in which the junction critical current could be varied by an external magnetic field. The phase slip in the junction was synchronized parametrically by a delay line connected to the junction. The purpose of these experiments was to study the phase slip process in inductively dominated Josephson junctions where LI_0 was much larger than the flux quantum, and where I_0 could be varied without changing either the junction geometry or the temperature. The bias voltage and magnetic field dependence of the phase slip and the relation of parametrically synchronized phase slip processes to frequency pulling in Josephson junction microwave emission experiments are discussed. (WHK)

16462 ANALOG COMPUTER STUDIES OF SUBHARMONIC STEPS IN JOSEPHSON JUNCTIONS. Hamilton, C. A. (National Bureau of Standards, Boulder, CO). pp 585-588 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A superconducting weak link (Josephson junction) which is exposed to microwave radiation exhibits constant-voltage steps in its V-I curve. These steps occur at the voltages $n(\hbar\omega/2e)$ and are a consequence of phase-locking between the applied radiation ω and the Josephson self-oscillation ω_0 ($\omega_0 = 2eV_{dc}/\hbar$). Certain types of junctions show additional steps at the voltages $(n/m)(\hbar\omega/2e)$, $n \neq m > 1$. These have become known as subharmonic steps. If the shunt conductance seen by the junction is sufficiently high, the Josephson current will significantly affect the junction voltage. This feedback situation results in the generation of harmonics of the self-oscillation. The subharmonic steps occur when one of these harmonics phase-locks with the applied radiation. (The term "harmonic steps" would thus be a more appropriate name.) An analog simulation of a Josephson junction is used in a circuit model to study the subharmonic steps. (WHK)

16463 APPLICATION OF ^{4}He CALORIMETER TO THE SPECIFIC HEAT OF TITANIUM. Agarwal, K. L.; Betterton, J. O. Jr. (Louisiana State Univ., New Orleans). pp 597-600 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A new low-temperature calorimeter for the study of impurity effects in titanium is described. In titanium, important effects on physical properties, such as the superconducting transition temperature, occur with only small amounts of impurities. The specific heat of high-purity titanium between 1.4 and 4.2°K is presented. (WHK)

16464 REVIEW OF THE EFFECTS OF HIGH MAGNETIC FIELDS ON LOW-TEMPERATURE THERMOMETERS. Sample, H. H.; Neuringer, L. J.; Rubin, L. G. (Massachusetts Inst. of Tech., Cambridge). pp 601-606 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Data on carbon resistors and thermocouples in high magnetic fields are presented. The magnetoresistance of Speer and Allen-Bradley resistors from 0.5 to 4.2°K and the magnetic field dependences of Au + 0.07 at. % Fe versus Chromel P and constantan versus Chromel P thermocouples between 4.2 and 4.5°K in dc magnetic fields up to 140 kG are discussed. (WHK)

16465 INDIUM-BARRIER-INDIUM TUNNELING JUNCTIONS. Jack, M. D.; Rochlin, G. I. (Univ. of California, Berkeley). pp 612-616 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

High-quality In-insulator-In tunnel junctions with resistance at 4°K varying over 12 orders of magnitude (from 0.01 Ω to 0.01 TΩ) were produced. Junction preparation involved the following new technique. An indium film was deposited onto a glass substrate held at liquid nitrogen temperature in a vacuum of 10^{-5}-10^{-6} Torr. After deposition the chamber was valved off and the sample gradually allowed to warm overnight to room temperature. The film was then placed in a reaction chamber consisting of a copper tube with two high-voltage copper electrodes at one end and a roughing line and gas bleeding line at the other. The position of the sample relative to the electrodes was the critical factor in varying the resistance of these junctions. High-impedance junctions faced toward the electrodes, while low-impedance junctions faced away. The vapor from a high-molecular-weight fluorocarbon liquid was continuously pumped through the chamber while a dc plasma discharge was maintained at pressures ranging from 300 to 750 μm for periods of 5 sec to a few minutes. Five cross strips of indium were then deposited at room temperature. Junctions of the following three types were produced: (1) intermediate junctions in the range 1 to 100 Ω, which exhibited pronounced structure in their d^2V/dI^2 characteristic, reflecting the In phonon spectrum; (2) low-impedance junctions, in the range 0.01 to 1 Ω, which exhibited Josephson junction characteristics; and (3) high and ultrahigh junctions in the range 10,000 Ω to 10,000MΩ. (auth)

16466 SUPERCONDUCTING STEPPING MOTORS FOR USE AT MILLIKELVIN TEMPERATURES. Edwards, D. O.; Kindler, R. L.; Shen, S. Y. (Ohio State Univ., Columbus). Rev. Sci. Instrum.; 46: No. 1, 108-109(Jan 1975).

Simple superconducting stepping motors capable of rotating apparatus at dilution refrigerator temperatures are described. The heat produced by friction in a motor and its 10:1 reduction gearing is 6 ergs per step of 3°. (auth)

16467 SUPERCONDUCTING MEASURES OF MAGNETIC INDUCTION. Kazantsev, Yu. I.; Yagola, G. K. Meas. Tech. (USSR) (Engl. Transl.); 17: No. 7, 1054-1056(Jul 1974).

Translated from Izmer. Tekh.; 17: No. 7, 47-49(Jul 1974).

Magnetic induction measures in the form of field coils or electromagnets are used for testing magnetic induction meters, as well as in physical experiments. Superconducting solenoids are the most convenient for use as magnetic induction measures in the range of strong magnetic fields. The specific properties which distinguish them from ordinary wire-wound field coils are discussed. (WHK)

16468 COMPARATOR FOR PRECISE MEASUREMENTS OF ALTERNATING CURRENT AMPLITUDES WITH A SUPERCONDUCTING QUANTUM GALVANOMETER. Vesker, B. A.; Zelikman, M. Kh.; Sokolov, E. A. Meas. Tech. (USSR) (Engl. Transl.); 17: No. 7, 1128-1129(Jul 1974).

Translated from Izmer. Tekh.; 17: No. 7, 90-91(Jul 1974).

The exceptionally low impedance of superconducting quantum galvanometers made in the form of Clarke's contacts (Phil. Mag., 13(1966)) or interferometers with point contacts, as well as their virtually zero resistance and inductance of the order of 10^{-11} to 10^{-13} H, make them suitable for measuring both direct and alternating currents. On the basis of Clarke's contact, a comparator model suitabie for measuring alternating (sinusoidal) current amplitudes with a precision approaching that of reference (standard) dc meters (error of 10^{-4}) was produced. (WHK)

16469 ELECTRON TUNNELING AND SUPERCONDUCTIVITY. Giaever, I. (General Electric Research and Development Center, Schenectady, New York). Rev. Mod. Phys. 46: No. 2, 245-250 (Apr 1974).

A recounting is given of the experiments performed in 1959 and 1960 on superconductive tunneling. (AIP)

16470 THE DISCOVERY OF TUNNELLING SUPERCURRENTS. Josephson, B.D. (Cavendish Laboratory, Cambridge, England). Rev. Mod. Phys. 46: No. 2, 251-254 (Apr 1974).

The experiments that led to the discovery of the Josephson effect are reviewed. (AIP)

16471 FIRST EVIDENCE FOR 1—MM WAVELENGTH PARAMETRIC AMPLIFICATION IN A JOSEPHSON JUNCTION MICROWAVE SOURCE. Ulrich, B.T.; Levinsen, M.T. (Department of Physics and Astronomy, University of Texas, Austin, Texas 78712). Appl. Phys. Lett. 26: No. 3, 131-133 (1 Feb 1975).

Our observation of 1—mm wavelength radiation generated in a cavity containing a Josephson junction provides evidence for a negative effective microwave resistance in the Josephson junction, and for parametric amplification in the reflection mode by the Josephson junction. These parametric oscillations were observed at wavelengths corresponding to cavity resonances between 1.1— and 2—mm wavelength. The frequency of the emitted radiation differed from the frequency given by $\nu = 2eV/h$, and thus the radiation was not simply from the ac Josephson effect. We develop a theory that predicts a negative microwave resistance at junction bias voltages just below a cavity—induced step for resistively shunted junction, and just above the cavity—induced step for a junction with sufficient shunt capacitance. Our observations are consistent with the theory. (auth)

16472 SUPERCONDUCTING MAGNET SYSTEMS. Brechna, H. Technische Physik in Einzeldarstellungen. Berlin, F.R. Germany; Springer (1973). 600p. (ISBN-3540061037). 396 figs.; 46 tabs.; 14 refs.

A comprehensive book on superconducting magnet systems dealing with the following main topics: Methods of magnetic field generation (high magnetic field laboratories, conventional continuous duty magnets with and without iron, pulsed magnets, cryogenic magnets, superconducting coils), magnetic field calculations (magnets without ferromagnetic yokes, magnetic fields due to coils in proximity to ferromagnetic materials, field calculation of iron-bound air-core magnets, calculation of forces and heating), phenomena and theory of superconductivity (free-electron, BCS, GLAG, critical fields and critical currents of type-II superconductors), superconducting alternating current magnets (AC losses, additional effects in twisted multifilamentary conductors, eddy current losses in metallic parts, multifilamentary conductors, comparison of loss calculation with experiments, methods of loss measurement, magnetic and thermal instabilities, AC magnet fabrication techniques, irradiation effects in superconducting magnets), cryogenics (general properties, handling, transferring and storage of cryogenic fluids, liquid level measurement, liquefaction and refrigeration, physical properties of cryogenic fluids and solids, heat losses), economic considerations in the design of water-cooled, cryogenic and superconducting magnets (cost comparison for specific magnet systems and in general), examples of superconducting magnet systems (Argonne National Lab., CERN, McGill and MIT, Oak Ridge, SLAC). References are given to each chapter. (GE)

16473 EXPERIMENTAL STUDY ON SUPERCONDUCTING NIOBIUM RESONATORS. Didenko, A. N.; Mel'nikov, M. V.; Mednikov, B. A.; Petrov, N. N.; Samojlenko, G. M.; Shiyan, V. P.; Yushkov, Yu. G. pp 43-45 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper presents the results of measuring parameters of superconducting niobium resonators, and considers the equipment used for this purpose. The resonator consists of a cylindrical can and cover made by turning on a lathe from electron-melted niobium ingots. Measurements of the resonator parameters were carried out at a temperature of 4.2°K. The measured value of the Q factor (quality factor) was 3×10^6. A comparison of experimental values with calculated data is presented. (tr-SJR)

16474 FLUID COOLED ELECTRICAL CABLE. Matthaus, G. (to Siemens Aktiengesellschaft). US Patent 3,835,240. 10 Sep 1974. Priority Date 28 Sep 1972, F. R. Germany. 8p.

A fluid cooled electrical cable is described. It includes an electrical conductor immersed in a low-temperature cooling medium, an inner tube in which the electrical conductor and cooling medium are disposed, a radiation shield disposed about the inner tube, an outer tube concentrically disposed about the inner tube and spaced apart therefrom, and superinsulation disposed about the radiation shield and the inner tube within the outer tube and in which the inner tube is suspended in the outer tube by means of suspension wires attached thereto. The improvement comprises the provision of axially displaceable mounting means, fastened to the radially inner surface of the outer tube and coupled to the suspension wires for restraining the inner tube from circumferential movement about its longitudinal axis with respect to the outer tube. The mounting means is configured as a plurality of spaced apart, elongated, slotted tracks fastened to the inner surface of the outer tube, and a plurality of rollers mounted on at least one transverse axle disposed therein to which the suspension wires are coupled. The assembly permits the axial displacement of the inner tube with respect to the outer tube but restrains circumferential movement of the inner tube. (Official Gazette)

Heat Transfer and Fluid Flow

Refer also to abstracts 18767, 18777, 18926, and 19077.

16475 (AERE-Trans-1128) HEAT TRANSFER TO WATER IN TUBE FLOW AT SUPERCRITICAL PRESSURE. Herkenrath, H. 1969. Translation of Thesis. 51p. Dep. NTIS (US Sales Only) $5.75. UK 40 pence.

Where the physical properties are variable, the known calculation procedures of the type Nu = f(Re,Pr) cannot be used for determining the heat-transfer coefficient. The empirical correction procedures frequently adopted in this case, in which Nu = f(Re,Pr) is multiplied by powers of $\overline{c_p}/c_{pB}$, λ_B/λ_w, η_B/η_w, and $\mathrm{Pr}_B/\mathrm{Pr}_w$, give acceptable results only over narrow ranges or where the physical properties do not change too abruptly or vary too widely. Where they vary so widely and in so irregular a manner as in the case of water in the supercritical pressure range, the correction procedures employed hitherto prove unsatisfactory, whether because of the lack of quantitative, or even qualitative, agreement with practical results or because of the exclusively empirical nature. The present work had two objectives, namely: (1) to carry out a precise experimental investigation of the heat-transfer coefficient of water in the supercritical pressure range of 225 to 250 bar; and (2) to derive from the Prandtl boundary-layer model a formula which would take account in a logical manner of the conditions obtaining when the physical properties vary widely. According to the Prandtl boundary-layer model, the thermal "total heat resistance" can, when calculating the heat-transfer coefficient of a single-phase medium, be represented as the sum of the partial resistances of the turbulent core and the laminar boundary layer. If, in the case of considerable temperature differences over the pipe cross-section, the bulk properties (c_{pB}) are inserted in the first term and the wall properties (η_w, λ_w and Pr_w) in the second, as is logical, the resulting constants being calculated as prescribed by Petukhov et al., a new heat transfer formula is obtained as follows: $(\xi/8)/\mathrm{St} = 1.07 + 12.7\sqrt{\xi/8}\,[\mathrm{Pr}_w^{2/3}(c_{pB}/c_{pw}) - 1]$. The satisfactory agreement between this formula and the measured results confirms the assumption that the special characteristics of heat transfer at supercritical pressures, particularly in the pseudocritical temperature range, are principally due to the marked temperature-dependence of the physical properties. This renders superfluous such hypotheses as processes similar to boiling (pseudo-boiling, etc.), which have often been proposed. (auth)

16476 (LA-5680) KACHINA: AN EULERIAN COMPUTER PROGRAM FOR MULTIFIELD FLUID FLOWS. Amsden, A. A.; Harlow, F. H. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 134p. Dep. NTIS $5.45.

Many fluid flow problems of interest involve the presence of bubbles, droplets, or chunks in a fluid. Because of the resulting likelihood for relative motion, more than one set of field variables is required to describe the dynamics. Until recently, numerical techniques for studying such flows have had very limited usefulness. A new computing program, named KACHINA, that significantly advances the ability to handle multifield flows is presented. KACHINA uses the powerful new Implicit, Multifield (IMF) computing method for handling different material fields, in which the multifield treatment is coupled with an implicit formulation of the equations, permitting calculation of fully interpenetrating flows that at any instant may have both supersonic and far subsonic or incompressible regions in the domain of interest. Although IMF-KACHINA development is a continuing project, the results have already proved its usefulness, even in its present state. The current KACHINA flow diagram and program listing are included. (auth)

16477 (RN-S-0274) DESIGN EQUATION ANALYSIS FOR HEAT TRANSFER TO CRYOGENIC HYDROGEN AT PRESSURES FROM 600 TO 1500 PSIA AND WALL-TO-BULK TEMPERATURE RATIOS TO 20. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1966. 68p. Dep. NTIS $6.50.

Experimental single-tube heat-transfer data from all available sources have been analyzed in terms of various design equations in an effort to select that model which best represents the data.

Cryogenic hydrogen data so analyzed were restricted to the pressure range from 600 to 1500 psia and to wall-to-bulk temperature ratios to 20. A graphical presentation of the ratio of the experimental to the computed heat transfer coefficient as a function of bulk temperature was made for each design equation studied. A lower-limit line was constructed as the locus of the high-density data point concentration; the nominal design equation was then established so that the lower limit line was 80% of the nominal equation. The level of confidence for each modified equation was then based on the percentage of data points located within the ±20% limits to the nominal lines. From these plots a variable liquid-side coefficient, C_L, was determined as a function of bulk temperature. Of the film temperature equations evaluated, that generated by Hess and Kunz appeared to best represent the data; for the equations based on the bulk temperature as reference, the equation known as REON "B" exhibited the least scatter. The results obtained by incorporating the variable C_L values for both these equations in the analysis of a reactor test of NERVA nozzle S/N-022 were compared with the predictions generated using the nominal design equations. Very little difference in the heat flux profile was found; changes in the coolant bulk temperature and pressure profiles were evident but not of great significance. However, appreciable differences in coolant-side wall temperatures were predicted, up to nearly 200°R just downstream of the nozzle throat. Limited braze alloy data tend to support the selection of the Hess and Kunz equation with variable C_L. A definitive selection of the best predictive equation, however, must await a more direct measurement of tube wall temperature, particularly in the divergent portion of the nozzle. (auth)

16478 (SAND-75-8207) CHARACTERIZATION OF UNSTEADY GAS DISCHARGE FROM A VESSEL. Johnston, S. C. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 288p. Dep. NTIS $17.50.

Thesis.

The discharge of compressed gas from a vessel through an orifice to the atmosphere was investigated and the effects of heat transfer on the discharge were evaluated. Included in the study were experiments to investigate (1) an uncoupling between the heat transfer and gas dynamic contributions to the instantaneous mass flow rate from the vessel, (2) the dynamics of the vessel wall diffusion layer (which is formed by heat addition from the vessel wall to the rapidly expanding gas), including buoyancy driven instabilities and their effect on the discharge process, and (3) bulk temperature evaluation from point temperature measurements in the highly nonuniform thermal environment of the discharging gas reservoir. In addition, a semiempirical theory for determining gas pressure and bulk temperature during discharge was developed. (auth)

16479 ANNUAL REVIEW OF FLUID MECHANICS. Volume 7. van Dyke, M.; Vincenti, W. G.; Wehausen, J. V. (eds.). Palo Alto, CA; Annual Reviews Inc. (1975). 415p. $15.00.

This work consists of several critical review articles on various aspects of fluid mechanics. The following topics are discussed: some memories of early work in fluid mechanics at the technical University of Delft; pressure fluctuations beneath turbulent boundary layers; nonlinear thermal convection; relaxation methods in fluid mechanics; experiments in granular flow; flow lasers; the structure and dynamics of vortex filaments; fluid mechanics of heat pipes; fluid mechanics of waste-water disposal in the ocean; hemodynamics; mathematical analysis of Navier-Stokes equations for incompressible liquids; experiments in rotating and stratified flows: oceanographic application; new trends in experimental turbulence research; the effect of waves on rubble-mound structures; and hydrodynamics of large lakes. (TFD)

16480 HYDRODYNAMIC THEORY CORRELATION FOR 72 HELIUM EVAPORATORS. Sydoriak, S. G. (Los Alamos Scientific Lab., NM). pp 607-611 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

It is shown how the hydrodynamic theory of channel boiling can be used as a basis for the correlation of critical channel boiling heat flux data for use in the design of cryogenic magnets. (WHK)

16481 PROTECTION DEVICE FOR TUBE-PLATE HEAT-EXCHANGERS. Perrier, J. (to Societe Stein Industrie). French Patent 2,183,539/A/. 9 May 1972. 12p. (In French).

This device is characterized in that it comprises, for each tube of the enclosure plate, a cylindrical coaxial sleeve surrounding said tube with a clearance along a portion of the length thereof and resting on said plate, said sleeve carrying, at the end thereof opposite said plate, a radially outwardly directed flange, the arrangement being such that the flanges of all the sleeves associated to the plate tubes are interlocked, thus obturating the free spaces defined by the sleeve outer faces, the flanges and said plate. This device can be applied to sodium-water exchangers. (FR)

Materials Testing

Refer also to abstracts 18766 and 18812.

16482 (BARC-768, pp 24-38) NEUTRON RADIOGRAPHY. Dande, Y. D. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

The design and applications of the Neutron Radiography Facility at the Apsara Reactor are described. The uses discussed include inspection of fuel elements, ordnance, and heavy metals. (TFD)

16483 (LA-3710) NONDESTRUCTIVE INCREMENTAL MASS MEASUREMENT OF ROVER FUEL ELEMENTS. Winkler, M. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 22 May 1967. Contract W-7405-eng-36. 10p. Dep. NTIS $4.00.

Declassified 29 Aug 1973.

The development of an instrument to measure the mass per unit length of Rover fuel elements described. A 10-Ci ^{60}Co source and an ionization chamber are utilized in a measurement of gamma-ray attenuation by the element under test. This attenuation is related to the mass per unit length of the element through the use of empirical standards. Instrumentation equipment provides both graphic and digital recording techniques. Calibration of this system has been accomplished to cover mass loss as a function of corrosion testing as well as mass addition as a function of protective coating processes. Mass changes of approximately ±0.2%, or greater, may be measured with this system. (auth)

16484 (TID/SNA-192) LOCATING TUBE BLOCKAGE THAT X-RAY CANNOT DETECT. Hendron, J. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). 23 Sep 1968. 17p. Dep. NTIS $4.00.

Results of an NDT program established to detect and define foreign-material inclusions in closed metal tube assemblies (when the foreign material is of a composition that cannot be detected by x-ray) are presented. These results may well be useful in resolving many inspection problems. (auth)

16485 (WANL-TME-395) EDDY-CURRENT FUEL ELEMENT FLAW DETECTOR. Gilmour, G. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Jul 1963. 6p. Dep. NTIS $4.00.

An eddy current fuel element flaw detector designed for field use in NRX cold flow tests is described. Estimates of the time required for probing of fuel elements and suggestions for proper use of the detector are given. (auth)

16486 (WANL-TME-968) REACTOR BOLT EVALUATION TESTS (EML-13). Krebs, A. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 20p. Dep. NTIS $4.00.

A test program was carried out to evaluate the assembly torque-preload characteristics of various threaded fasteners used in the NRX-A reactors. All of these evaluation tests were performed on specification grade reactor fasteners using test fixtures which provided close simulation of the service environments of these parts. No excessive friction or galling problems were experienced during assembly or disassembly, and the specified design requirements for axial preload and strength at the specified assembly torques were met. Threaded fastener assemblies of different material combinations were tested at cryogenic conditions to determine whether differential thermal contractions would have an important effect on the disassembly torque. No measurable temperature effect was observed. (auth)

16487 RADIOGRAPHIC EQUIVALENCE FACTOR IN GAMMA-RADIOGRAPHY. da Costa, F. C. (Inst. of Aeronautical Tech., San Jose Dos Campos, Brazil). Rev. Brasil. Tecnol.; 5: No. 1/2, 35-42(1974). (In Portuguese).

The calculation of exposure time in gamma radiography has been shown as a practical problem. The exposure curves are made experimental and are usually constructed for iron (steel).

In this paper a theoretical approach is tried, not concerning the whole problem, but only part of it. This part is related to radiographic equivalence factor which refers other materials to iron and its uses in exposure curves. (auth)

16488 GAMMA AUTORADIOGRAPHY IN GLASS. Polyukhov, V. G.; Gabeskiriya, V. Ya. Sov. At. Energy (Engl. Transl.); 36: No. 3, 276-277(Mar 1974).

Translated from At. Energ. (USSR); 36: No. 3, 223-224(Mar 1974).

In autoradiographic studies of highly active objects, one ordinarily employs a special emulsion layer the use of which involves a number of difficulties under conditions where high radioactive contamination, high humidity, or corrosive vapors are present. Glass is the most convenient radiosensitive material for use under such conditions. In the present autoradiographic study of ampules irradiated in the SM-2 reactor, ordinary showcase glass (All-Union State Standard 7380-55) 5.8 ± 0.3 mm thick was used in the form of strips 30 × 500 mm in size. The diameter of the active portion of the ampules was 10 mm with lengths up to 350 mm. The studies were carried out in hot cells. The procedure and results are described. (WHK)

16489 NOVEL TECHNIQUES IN NEUTRON RADIOGRAPHY WITH A 35 MeV LINEAR ELECTRON ACCELERATOR. Hewitt, J. S.; Aydogdu, M. K.; Blumenauer, G. R.; Robitaille, H. A. (Univ. of Toronto). Non-Destruct. Test. (Guildford, Engl.); 7: No. 6, 315-323(Dec 1974).

Thermal and epithermal neutron radiography was investigated using a 35-MeV pulsed electron linac with emphasis on image resolution. A technique using multiple cadmium filters was developed to improve contrast in radiographs of hydrogenous objects. Preliminary results demonstrating the feasibility of stroboscopic neutron radiography are presented. (auth)

16490 TRIBOLOGY FOR THE ATOMIC AND SPACE INDUSTRIES. Robbins, E. J. (UKAEA Reactor Group, Risley, Eng.). Ind. At. Spatiales; 18: No. 2, 23-33(Mar 1974). (In English and French).

The National Center of Tribology in Risley, near Warrington, affords services of consultation and development in the field of friction, wear, and lubrication. The installations used for testing the materials under the agressive ambient conditions which characterize nuclear reactors, i.e., carbon dioxide, helium, and sodium at temperatures as high as 800°C are described. The work carried out in the European Laboratory of Space Tribology, which constitutes a part of the National Center is presented. The chief activities are the testing of the mechanisms of satellites under conditions which reproduce closely those encountered in space, and research on the processes of tribology in extreme vacuum. (FR)

16491 SURVEY OF IMAGE PROCESSING METHODS FOR RADIOGRAPHY. Holloway, J. A. (Air Force Materials Lab., Wright-Patterson AFB, OH); Shelton, W. L.; Mitchell, J. P. pp 110-117 of Sixth National SAMPE Technical Conference. Vol. 6. Azusa, CA; Society for Advancement of Material and Process Engineering (1974).

From sixth national SAMPE technical conference on materials on the move; Dayton, Ohio, USA (8 Oct 1974). See CONF-741058-.

An investigation of radiographic image processing methods using analog, digital and photographic approaches was conducted. Several systems were evaluated to determine the state-of-the-art for enhancement of industrial radiographs. Control radiographs were used to determine system capabilities such as resolution and sensitivity, dynamic range, degree of enhancement, speed, scan area, reproducibility, and cost. (auth)

Nuclear Explosions

Refer also to abstracts 16364, 16841, and 19112.

16492 (MP-E-74-6) REVIEW OF EXPLOSIVES USED IN EXPLOSIVE EXCAVATION RESEARCH LABORATORY PROJECTS SINCE 1969. Reed, H. H. (Army Engineer Waterways Experiment Station, Livermore, Calif. (USA). Explosive Excavation Research Lab.). Jun 1974. 60p. Dep. NTIS $7.60.

Since 1969, the Explosive Excavation Research Laboratory (EERL) has been engaged primarily in using commercially developed explosives and blasting agents in a variety of explosive excavation jobs and experiments. Dry and wet (slurry) explosives and blasting agents have comprised the bulk of these products, which are generally fuel-oxidizer mixes with an ammonium nitrate base. General properties of these explosives are covered. The specific products used by EERL are discussed in detail as are the media in which they were used. The present techniques available for procuring explosives are also discussed. (auth)

16493 (SAND-74-0205) UNMANNED SEISMOLOGICAL OBSERVATORY: SEISMOMETERS AND SIGNAL PROCESSING. Final Report. Stearns, S. D.; Durham, H. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. 63p. Dep. NTIS $6.25.

This is the final report on a one-year study of portions of the unmanned seismological observatory (USO). Specifications and design criteria are given for its signal-processing sections. These include the seismometers, analog signal processing equipment, analog-to-digital converters, and digital filters. The results of a literature study of the earth's seismic background are also included. (auth)

16494 (UCID-30012) SOC USER'S MANUAL. Cherry, J. T.; Petersen, F. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 May 1971. Contract W-7405-eng-48. 52p. Dep. NTIS $5.75.

The SOC code provides a numerical solution to the propagation of a stress wave of arbitrary amplitude through a Lagrangian grid in one space dimension (spherical symmetry). The code has been structured to accept material properties data from a preshot testing program in order to predict the stress-induced effects on a rock mass caused by an explosive source. The code calculates stress, particle velocity and displacement history, cavity radius, extent of brittle failure, and the rock's efficiency for transmitting stress. Physics documentation is given in UCRL-72216, "Numerical Simulation of Stress-Wave Propagation from Underground Nuclear Explosions," by J. T. Cherry and F. L. Petersen, Jan. 13, 1970. (auth)

16495 (UCRL-75899) LEACHING OF PRIMARY SULFIDE ORES IN SULFURIC ACID SOLUTIONS AT ELEVATED TEMPERATURES AND PRESSURES. Leach, D. L.; Braun, R. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Nov. 1974. 35p. (CONF-750204-1). Dep. NTIS $4.75.

From annual meeting of the Society of Mining Engineers of AIME; New York, New York, USA (16 Feb 1975).

In situ leaching of primary sulfide ore provides a possible means of recovering copper from deposits that are too deep to be mined economically by conventional methods. The first step in such a process is the rubblization of a region of the ore deposit by the use of nuclear explosives or, alternatively, by undercutting and caving assisted by conventional methods. Laboratory experiments simulating in situ copper recovery from primary sulfide ores in sulfuric acid systems pressurized with oxygen are described. Copper extraction and acid consumption data are correlated with temperature in the range 50 to 150°C and quenched pH in the range 0.25 to 2. Adverse changes in the chemical composition of the leach solution and the formation of gangue-mineral alteration products and secondary sulfides can severely limit the extraction of copper above 90°C. Keeping the pH below the self-buffered value of about 2 and the temperature below about 110°C produces the maximum extraction rates. Forcing the pH too low not only results in excessively high acid consumption but may also limit the extraction of copper at temperatures above 100°C. (TFD)

16496 (UCRL-76277(Rev.1)) POTENTIAL PATHWAYS TO MAN FOR RADIONUCLIDES FROM CONTAINED APPLICATIONS OF PEACEFUL NUCLEAR EXPLOSIVES. Tewes, H. A.; Schwartz, L. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1974. 38p. (CONF-750109-5). Dep. NTIS $5.00.

From fourth IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

In planning for the utilization of Peaceful Nuclear Explosives (PNE) in various contained applications, it has been necessary to study a number of safety related topics to assure the acceptability of these proposed applications. One of the most intensively investigated of these topics is radiological safety. Not only must the phenomenological aspects of PNE contained applications be considered, but also both the subsequent resource recovery operations and the mode of resource utilization. Potential pathways resulting in exposure of the public to radioactivity have been identified for these phases in various proposed contained PNE applications, and the relative radiological health impacts have been approximately quantified. (auth)

16497 (UCRL-76280) PROJECT RIO BLANCO: PROJECT SCIENTIST'S SUMMARY REPORT OF PRODUCTION TEST DATA AND PRELIMINARY ANALYSIS OF TOP CHIMNEY/CAVITY. Toman, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1974. 33p. (CONF-750109-6). Dep. NTIS $4.75.

From fourth IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

The reentry drilling established communication with the top Rio Blanco detonation region at a depth of 1704 m, or about 76 m above the top detonation center. A total of 2.8×10^6 m^3 of dry gas at standard conditions has now been produced during two separate test periods. Radioactive and chemical analysis of this gas and the modeling of the stimulated reservoir shows the following main results: No permeable connection exists between the top and the middle detonation regions, since none of the tracer incorporated in the center explosive canister was detected in the produced gas. As a consequence, results for the top detonation region only are available at this time. The initial cavity radius is deduced to be 20 m or well within expectations. Integration of the ^{85}Kr produced indicates a yield of 34 ± 3 kt for the top explosive. Of the approximately 1000 curies of tritium produced in the top explosion region, about 5% is incorporated in the gas phase. Pressure drawdown and buildup data are best reproduced by a two-layer reservoir model showing stimulated permeabilities about 10 and 30 times original formation permeabilities, and extending to a distance of about three cavity radii from the wellbore. The capacity of the reservoir intercepted by the top explosive is deduced to be about 0.2 millidarcy-meters, as contrasted with preshot estimates ranging from 1.3 md-m to 2.3 md-m. The reason for this discrepancy is not resolved at this time. Additional subsurface investigations of the other detonation regions as well as a reevaluation of the initial reservoir properties are in progress. (auth)

16498 (UCRL-76281) IN SITU LEACHING OF A NUCLEAR RUBBLIZED COPPER DEPOSIT. Braun, R. L.; Lewis, A. E.; Mallon, R. G.; Sisemore, C. J.; Tewes, H. A.; Hard, R. A.; Klumpar, I. V.; Petrovic, L. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Dec 1974. 48p. (CONF-750109-2). Dep. NTIS $5.50.

From fourth IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

Copper recovery using nuclear rubblization and in situ leaching has been studied to estimate the economic feasibility and to identify problem areas for future research and development. A plan for commercializing this chemical mining process was built around a detonation schedule of 10 chimneys every 3 y, a leaching cycle of six years, and an annual copper production of 40,000 tons (metric). The results show that recovery using this method is profitable for a type of deposit that would be unprofitable by any conventional method. The release of radioactivity from the chimney during re-entry and leaching operations, and the contamination of ground water and copper product were studied. A careful estimate of expected radiological exposures to plant workers and to the public indicates that all exposures will be below established guidelines. (auth)

16499 ARTIFICIAL THERMOLUMINESCENCE OF GRANITES SUBJECTED TO UNDERGROUND NUCLEAR EXPLOSIONS. Faure, J.; Polveche, J. (Univ., Nice). Compt. Rend., Ser. D; 279: No. 1, 25-28(1 Jul 1974). (In French).

The artificial thermoluminescence of granites (Taourirt Tan Agella, Hoggar, Algeria) was measured after underground nuclear explosions. The variations of the artificial thermoluminescence show the importance of the dynamic and thermal effects to which the rocks were subjected. (FR)

16500 PLANT FOR DETECTING NUCLEAR EXPLOSIONS. Fothergill, R. A.; Hicks, G. G.; Norman, K. G.; MacGovern, A. J. (to United Kingdom Atomic Energy Authority). Norwegian Patent 129,425. 5 May 1967. Priority Date 6 May 1966, United Kingdom of Great Britain and Northern Ireland. 19p. (In Norwegian).

The system consists of separate transducers which convert the rapidly rising and the slowly rising parts of the optical transient from a nuclear explosion to separate and independent electric signals, and a signal processing arrangement consisting of a first signal detector which transmits an output pulse only when the signal from a transducer for the radio frequency transient from the nuclear explosion exceeds a given rate of increase, is shorter than a given duration, and exceeds a given strength; a second signal detector which transmits an output pulse only when the signal from the rapidly rising part of the optical transient exceeds a given duration; and a third signal detector which transmits an output pulse only when the slowly rising part of the optical transient exceeds a given rate of increase and is longer than a given duration. These signal detectors are connected to an explosion indicator which indicates a nuclear explosion only when the first, second and third pulses come in a given order, which observations show is typical for nuclear explosions and thus prevents confusion with, e.g., lightning. (NO)

Protective Structures and Equipment

16501 (LA-5755) DEMOLITION OF BUILDING 12, AN OLD PLUTONIUM FILTER FACILITY. Christensen, E. L.; Garde, R.; Valentine, A. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Jan 1975. Contract W-7405-eng-36. 20p. Dep. NTIS $4.00.

The decommissioning and disposal of a plutonium-contaminated air filter facility that provided ventilation for the main plutonium processing plant at Los Alamos from 1945 until 1973 are described. The health physics, waste management, and environmental aspects of the demolition are also discussed. (auth)

16502 (LA-5797-PR) AEROSOL RESEARCH AND DEVELOPMENT RELATED TO HEALTH HAZARD ANALYSIS, JANUARY 1–JUNE 30, 1974. Ortiz, L. W.; Ettinger, H. J.; Fairchild, C. I.; Tillery, M. I. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 13p. Dep. NTIS $4.00.

Evaluations of 10-mm nylon cyclones for estimating respirable mass of airborne fibrous glass were continued during this quarter. Current results indicate reasonable estimates of respirable mass fraction when the cyclone is operated at a flow rate of 1.7 liter/min. Mass median aerodynamic diameters (mmad) of the aerosols used in this evaluation have ranged from 3.1 to 4.0 μm with geometric standard deviations of ~1.8. Measurements of coal dust loading effects on performance of nylon cyclone personal samples were completed during this quarter. Cyclone loading was found to cause negligible errors in estimates of respirable mass under normal sampling conditions. Loading of the second stage filter was found to have a greater effect. These errors are small relative to inherent field sampling errors. Electrical charge was also observed to have a minimal effect on performance of the cyclone when sampling coal dust. (auth)

16503 (LA-5805-PR) RESPIRATOR STUDIES FOR THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH. Progress Report, July 1, 1973–June 30, 1974. Held, B. J.; Revoir, W. H.; Pritchard, J. A.; Hack, A. A.; Geoffrion, L. A.; Davis, T. O.; Lowry, P. L.; Richards, C. P.; Wheat, L. D.; Hyatt, E. C. (Los Alamos Scientific Lab., N.Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 45p. Dep. NTIS $4.00.

Respirator studies carried out in FY 1974 for the National Institute for Occupational Safety and Health were concentrated in two major areas: (1) the development of respirator test equipment and methods to improve the means of evaluating the performance of respirators, (2) the testing of respirators to obtain quantitative data to permit recommendations to be made to upgrade respirator performance criteria. (auth)

Safety Engineering

16504 (UCRL-76169) FIRE PROTECTION ENGINEERING ASPECTS: INDUSTRIAL, COMMERCIAL, AND ATOMIC ENERGY PROBLEMS. Purington, R. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Oct 1974. 47p. (CONF-740240-1). Dep. NTIS $5.50.

From earthquake seminar, USNAS; Treasure Island, California, USA (20 Feb 1974).

Damage to various facilities at the Lawrence Livermore Laboratory from the San Fernando earthquake is summarized. The material is presented by 39 visual slides. Remedial actions to prevent future damage are discussed. (TFD)

16505 FIRE-EXTINGUISHER FOR LIQUID SODIUM FIRES. Falgayrettes, M.; Sauvage, M.; Pontier, R. (to Commissariat a l'Energie Nuclear). French Patent 2,185,153/D/. 18 May 1972. 7p. (In French).

A receptacle device is described for extinguishing liquid sodium fires. It is characterized in that it comprises, in combination with a metal-sheet receptacle for collecting sodium flowing by gravity from a leak, a metal-sheet adapted to close the upper portion of said receptacle almost completely and to smother and channel the sodium from said leak into the receptacle and within the latter, a high thermal capacity material in divided form so as to offer a large exchange surface to the sodium spreading throughout the receptacle at the moment a leak occurs. (FR)

ENVIRONMENTAL AND EARTH SCIENCES

Minerals and Ores

Refer also to abstract 16547.

16506 (NP-20282) METHODS OF PROSPECTING FOR URANIUM. (Atomic Energy Commission, Athens (Greece)). 1974. 96p. (In Greek). Dep. NTIS (US Sales Only) $8.00.

The geological, radiometric, and geochemical methods used in the prospecting for U in Greece are described in detail. The data processing is briefly described. (JSR)

16507 (ORNL-tr-2894) CHEMICAL AND ISOTOPIC STUDIES OF THE OKLO NATURAL REACTOR. Hagemann, R.; Nief, G.; Roth, E. Translated by Martha Gerrard from Bull. Inform. Sci. Tech. (Paris); 193: 65-76(1974). 19p. Dep. NTIS $19.

The functioning of the Oklo natural reactor has drastically transformed the chemical and isotopic composition of the minerals present. It is shown that most of the fission elements have remained in place, evidence is given of those that have migrated outside the reaction zone, then the way in which the functioning of this reactor can be described from an analysis of these elements is demonstrated. Preliminary results are given concerning the date and lifetime of the phenomenon, the fluence and the spectrum indication obtained from the study of neodymium, lead, rubidium, strontium, rare gas and ruthenium isotopes. (auth)

16508 STUDY OF SOME OKLO SAMPLES BY IONIC SAMPLES. Slodzian, G. (Univ., Paris); Havette, A. Bull. Inform. Sci. Tech. (Paris); No. 193, 81-86(Jun 1974). (In French).

Samples from the Oklo deposit were studied using an ion probe. The distribution of the different elements (rare earths, Pb, U) was established and the migration of the radionuclides into the deposit evaluated. The age of the deposit was estimated with a good approximation. (FR)

16509 STUDIES OF IRRADIATION DAMAGES AND U MICRODISTRIBUTION IN SAMPLES OF THE OKLO DEPOSIT. Dran, J. C. (CNRS, Orsay, France); Maurette, M.; Duraud, J. P. Bull. Inform. Sci. Tech. (Paris); No. 193, 59-63(Jun 1974). (In French).

Samples of the Oklo deposit were analyzed in order to determine certain characteristics of the Oklo reactor (thermal and fast neutron fluences, reactor operation temperature). The results are discussed. (FR)

16510 ISOTOPIC ANALYSIS OF RARE EARTHS IN THE ORE OF THE OKLO FOSSIL REACTOR. Neuilly, M.; Dozol, J. F. (CEN de Cadarache, Saint-Paul-les-Durance, France). Bull. Inform. Sci. Tech. (Paris); No. 193, 77-80(Jun 1974). (In French).

Samples from the Oklo deposit were systematically analyzed using mass spectrometry. The results obtained concerning Nd, Sm, and Eu isotopes are given. (FR)

16511 BASIC MAGMA AS A GUIDE TO THE DISTRIBUTION OF URANIUM DEPOSITS IN FRENCH GRANITOID ROCKS. Carrat, H. G. (Ecole National Superieure de Geologie Appliquee et de Prospection Miniere, Nancy). Compt. Rend., Ser. D; No. 2, 115-118(8 Jul 1974). (In French).

While it is accepted that uranium is mainly found in granitoid rocks, and while enrichments in the form of scattered minerals are easily explained by migration processes peculiar to these rocks, the mechanism of pitchblende concentration involves the basic magma formation where the CO_2, which plays a decisive part in the deposition of the ore, has its origin. A study of the basic rock distribution in the earth's crust is thus a useful prospection guide. (FR)

16512 OKLO NATURAL REACTORS. Situation on May 1st 1974. Naudet, R. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 193, 7-45(Jun 1974). (In French).

The history of the discovery and the essential facts are outlined: prospection of the site, material evidence of the reactors, search for reaction centers, field work, main results of site exploration, sampling accomplished and in progress. The reactor aspects are studied (criticality conditions, fission product analysis, analysis along section through the reactors, neutronic interpretation, fine distribution and marginal situations, lifetime of the phenomenon, reaction control mechanisms) together with the earth science aspects (geological context, geochronological research, problems of uranium build-up in high concentration pockets, geochemical and mineralogical research, diageneses and its relations with nuclear reactions). (FR)

16513 OBSERVATIONS CARRIED OUT IN THE PILE ZONE OF THE OKLO DEPOSIT. Weber, F. (CNRS, Strasbourg). Bull. Inform. Sci. Tech. (Paris); No. 193, 47-49(Jun 1974). (In French).

A geological study of the Oklo deposit is presented. (FR)

16514 MICROSCOPIC STUDY OF THE URANIUM ORES OF OKLO DEPOSIT. Geffroy, J.; Lissillour, J. (CEA Direction des Productions, Chatillon, France). Bull. Inform. Sci. Tech. (Paris); No. 193, 51-58(Jun 1974). (In French).

At Oklo, two types of ores can be distinguished: types with carbonaceous matter, observable in the sandstone or conglomeratic rocks: dissemination of pitchblende (colloform UO_2) with sometimes coffinite, in a polymerized asphaltic material; types with uraninite (euhedral UO_2), often massive, in a clay mineral matrix with dominant chlorite. The whole is intersected or scattered in micro-breccia by galena with almost entirely radiogenic lead. The ^{235}U-depleted ores were observed only in this second type of ores. Nevertheless, no difference from mineralogical viewpoint is observable between normal uraninite ores, and those from Oklo with modified isotopic spectra. In these particularly, no evidence of thermal or mechanical modification have been recorded. (FR)

16515 CHEMICAL AND ISOTOPIC STUDIES OF THE OKLO NATURAL REACTOR. Hagemann, R.; Nief, G.; Roth, E. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 193, 65-76(Jun 1974). (In French).

The functioning of the Oklo natural reactor has drastically transformed the chemical and isotopic composition of the minerals present. It is shown that most of the fission elements have remained in place, evidence is given of those that have migrated outside the reaction zone, then the way in which the functioning of this reactor can be described from an analysis of some of these elements is demonstrated. Preliminary results are given concerning the date and life of the phenomenon, the fluence and the spectral index obtained from the study of neodymium, lead, rubidium, strontium, rare gas and ruthenium isotopes. (FR)

16516 URANIUM IN KIMBERLITE AND ASSOCIATED ROCKS, WITH SPECIAL REFERENCE TO LESOTHO OCCURRENCES. Kresten, P. (Univ. of Stockholm). Lithos; 7: No. 3, 171-180 (1974).

Uranium contents of 27 kimberlites, 6 ultrabasic nodules, and 17 different minerals from these rocks are given. The average uranium contents are (all data published so far): basaltic kimberlite 2.35 ppM; micaceous kimberlite 4.91 ppM; ultrabasic nodules 0.20 ppM U. Among the minerals analyzed, only four (apatite, perovskite, zircon, ZrO_2) show uranium contents >1 ppM. Perovskite and apatite are the main carriers of uranium in basaltic and micaceous kimberlites, respectively. It is concluded that uranium must have been added to kimberlite from an outside source. (auth)

16517 MECHANISM OF METAMICTIZATION OF MINERALS UNDER THE ACTION OF AUTORADIATION. Polezhaev, Yu. M. (Ural Polytechnic Inst., Sverdlovsk, USSR). Geokhimiya; No. 11, 1648-1653(Nov 1974). (In Russian).

Transition from the crystalline state to the amorphous one under the action of autoradiation occurs omitting the liquid phase, the local heating of the matter in temperature peaks, and its expansion within the incompressible solid body causing an uneven pressure increase, which deforms the structure. Structure deformations is considered as the first stage of metamictization, the further course of the process is predetermined by other factors. (auth)

16518 URANIUM SILICATES IN THE PROCESS OF HYDROTHERMAL URANIUM ORE FORMATION. Bayushkin, I. M.; Dikov, Yu. P. (Inst. of Geological Exploration, Moscow). Geokhimiya; No. 11, 1654-1663(Nov 1974). (In Russian).

The possibilities of the formation of uranium oxides and silicates in the hydrothermal process are examined. A variant of the formation of uranium silicates of the coffinite type during the process of destruction of intermediate metastable alkaline uranium silicates or alkaline uranosilicates is proposed for discussion. (auth)

16519 MINERALOGY OF METAMICT RARE EARTH AB_2O_6-TYPE NIOBIUM-TANTALUM-TITANIUM OXIDES. Ewing, R. C. Stanford, CA; Stanford Univ. (1974). 171p. University Microfilms Order No. 74-27,013.

Thesis (Ph. D.).

The metamict rare earth AB_2O_6-type niobium-tantalum–titanium oxides (A = REE, U, Th, Ca, Fe^{+2}, Mn, Pb; B = Nb, Ta, Ti, Fe^{+3}) have been a mineralogical headache since their initial description in the 1800's due to their complex compositions, metamict state, and the pervasive effect of alteration. A thorough and systematic examination was made of these complex niobium–tantalum–titanium oxides and a simple and self-consistent nomenclature developed based on a statistical analysis of the data (129 cases) presently in the literature and the systematic determination of relevant mineralogic parameters on documented samples. The laboratory examination of museum specimens consisted of determination of physical parameters (VHN_{50}, reflectance, R. I. and S. G.); DTA, x-ray powder diffraction and infrared absorption (250 to 4000 cm^{-1}) analysis of metamict and recrystallized products of annealing runs; measurement of low energy (20 to 610 KeV) natural gamma-ray spectra; electron microprobe analysis of altered and unaltered zones; and synthesis in simplified systems of β-$CeNbTiO_6$ and α-$YNbTiO_6$. The mechanism of metamictization is considered by comparison of structural and compositional features of metamict and non-metamict niobium–tantalum–titanium oxides. Physical properties vary over a wide range: (1) R. I., 2.00 to 2.22; (2) reflectance, 11.9 to 15.6 (470 nm), 11.7 to 15.6 (546 nm), 11.0 to 15.0 (589 nm) and 11.6 to 15.6 (650 nm); (3) VHN_{50}, 621 to 746; and (4) S. G., 4.30 to 5.87. The R. I., reflectance and S. G. decrease with alteration and the concomitant increase in absorbed and structural water. VHN_{50} decreases with increasing metamictization, but the VHN_{50} of annealed specimens increases to approximately 1000. The metamict specimens are amorphous x-ray diffraction; and infrared absorption spectra show broad, weak absorption bands from 3700 to 3000 cm^{-1} and at 600 cm^{-1}. For partially crystalline specimens, there are absorption bands at 570 and 430 cm^{-1}. For annealed (400 to 1100°C at 50 degree intervals in air) specimens, euxenite, priorite-aeschynite, pyrochlore, brannerite, Nb_2TiO_7, rutile and anatase were identified by x-ray powder diffraction. During annealing, priorite–aeschynite, crystallizes as the low temperature phase (400°C) and is followed by the formation of the high temperature euxenite phase (700 to 750°C). The transition of priorite-aeschynite to euxenite may occur over a range of temperatures, 550 to 750°C, for yttrium-rich compositions and 900 to 1000°C for cerium-rich compositions. In most cases the cubic pyrochlore phase is present from 400 to 1100°C. Unit cell parameters were measured for euxenite, priorite-aeschynite and pyrochlore at 600 and 900°C. Annealing at 500 to 600°C caused metamict specimens to give infrared absorption spectra characteristic of partially metamict specimens. Primary and secondary alteration affects compositions, physical properties and the results of annealing studies. For primary alteration there is a consistent increase in calcium content, a decrease in the uranium to thorium ratio, a decrease in the absolute rare earth concentrations with relative rare earth distributions remaining constant (there is one notable exception), a slight but significant decrease in B-site cations and an increase in structural and absorbed water. Secondary alteration is similar in effect to primary alteration but with a decrease in calcium content and an increased leaching of A-site cations and subsequent relative increase in B-site cations. The deviation from stoichiometric proportions of A- and B-site cations with increased alteration results in complex recrystallization phase assemblages during annealing. An example of natural spherulitic recrystallization due to a post-metamictization thermal event is described. The effect of alteration and recrystallization on systems of nomenclature and identification procedures is discussed. (Diss. Abstr. Int., B)

Radioactive Effluents

Refer also to abstracts 16039, 16523, and 16528.

Radioactivity Monitoring and Transport

Refer also to abstracts 16039, 16586, 16839, 16909, 16910, and 19119.

16520 (AERE-R-7832) RADIOACTIVE FALLOUT IN AIR AND RAIN: RESULTS TO THE MIDDLE OF 1974. Cambray, R. S.; Fisher, E. M. R.; Eakins, J. D.; Pierson, D. H. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Nov 1974. 55p. Dep. NTIS (US Sales Only) $5.75. UK £1.00.

Samples of atmospheric dust and rainwater were collected in the United Kingdom and elsewhere. Results are presented of analyses of these samples for fallout of various fission products and certain other radionuclides. An estimate was made of the worldwide deposit of ^{137}Cs and ^{90}Sr in rain to the end of 1973; the cumulative deposit has remained substantially constant since 1966. The total deposit of long-lived activity in the northern hemisphere is about three times that in the southern hemisphere. (CH)

16521 (BNWL-B-385) MASTER SCHEDULE, CY-1975: HANFORD ENVIRONMENTAL SURVEILLANCE ROUTINE PROGRAM. Effective November 1, 1974. Fix, J. J.; Corley, J. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-1830. 44p. Dep. NTIS $4.00.

The current schedule of data collection for the routine environmental surveillance program at the Hanford plant is presented. The intent of the program is to evaluate the levels of radioactive and non-radioactive pollutants in the Hanford environs. Environmental samples are collected from locations expected to indicate the maximum effect from Hanford operations. Samples are collected from all significant media categories including soil, water, air, milk, etc. Changes continue to be made in the groundwater surveillance program to provide improved delineation of tritium and nitrate ion concentrations in groundwater. (CH)

16522 (JPRS–63757) METHODS AND EQUIPMENT USED IN HYDROPHYSICAL INVESTIGATION OF OCEAN TURBULENCE AND RADIOACTIVITY. Translated from Morsk. Gidrofiz. Issled.; 50: No. 4, 176-192; 204-207(1970). 19p.

The report contains a discussion of the problem involving the possibility of measuring the parameters of locally isotropic turbulence in the atmosphere and ocean with the aid of optical methods permitting the recording of fluctuations in the amplitude and phase of a plane light wave, propagating in a turbulent medium, and a description of a scintillation detector for measuring sea water radioactivity. (JPRS)

16523 (KFK-1912) PRODUCTION AND RELEASE OF RADIOIODINES BY NUCLEAR POWER PLANTS AND REPROCESSING PLANTS AND THE EXPECTED RADIOLOGICAL BURDEN TILL THE YEAR 2000. Proz, E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Mar 1974. 79p. (In German). INIS.

Production of radioiodines is summarized in this report, together with the yields from nuclear weapons and nuclear facilities. Specific production rates and the current release rates are evaluated for the different types of nuclear power plants. Release rates from fuel reprocessing plants are also included. For a 1,500 t/a reprocessing plant, a decay-decontamination factor study was performed with the condition that a dose of 90 mrem/a is not exceeded. Based on the projected number of nuclear facilities till the year 2000, the time-dependent production rates as well as the global inventory are calculated. (auth)

16524 (WASH-1359) PLUTONIUM AND OTHER TRANSURANIUM ELEMENTS: SOURCES, ENVIRONMENTAL DISTRIBUTION AND BIOMEDICAL EFFECTS. Wachholz, B. W. (comp.). (USAEC, Washington, D. C.). Dec 1974. 327p. Dep. NTIS $10.60.

Separate abstracts were prepared for the nine papers included. (CH)

For abstracts of individual papers see: 16525–16527, 16540, 16541, 16857, 16861, 16862, and 18668.

16525 (WASH-1359, pp 13-30) POTENTIAL SOURCE TERMS AND CONTROL MEASURES [FOR TRANSURANIUM ELEMENTS]. Yoder, R. E. Jr. (Atomic Energy Commission, Washington, DC). Dec 1974.

In plutonium and other transuranium elements.

The current sources of transuranium materials (^{238}Pu, ^{239}Pu, ^{252}Cf, and ^{244}Cm) within the Atomic Energy Commission (AEC) operations are reviewed and an indication of projected inventories and an overview of control measures taken to reduce effluents are presented. There have been accidental releases of Pu to the environment and these have been well publicized. The quantities of materials involved in these instances have ranged from much less than one to a few kilograms of material, and steps have been taken to reduce the accident potential in AEC operations. Because the AEC is concerned about environmental discharges and any attendant buildup in the environment, it is fully implementing the as low as practicable concept. In those instances in which environmental cleanup actions have been required, specific measures tailored to the situation have been used. Because the number of the cases is very small, they are best handled on a case-by-case basis so that a comprehensive evaluation can be made to effectively limit the availability of these materials. (CH)

16526 (WASH-1359, pp 89-112) ENVIRONMENTAL LEVELS OF PLUTONIUM AND THE TRANSPLUTONIUM ELEMENTS. Wrenn, M. E. (Atomic Energy Commission, Washington, DC). Dec 1974.

In plutonium and other transuranium elements.

The major transuranic activity in the environment is composed of ^{239}Pu, ^{240}Pu, and ^{241}Am from weapons testing, and ^{238}Pu from the SNAP-9A burnup in 1964. This material is detectable in surface soils around the world, although their presence raises the α background in surface soils generally less than 1%. The Pu and Am activity per gram near the surface will decrease slowly with time. Local sources of Pu, although much smaller in quantity than that from globally distributed weapons testing fallout, can result in concentrations of Pu in soil exceeding the concentrations of the global level from weapons testing. (auth)

16527 . (WASH-1359, pp 115-128) WORLDWIDE DISTRIBUTION OF PLUTONIUM. Hardy, E. P. Jr. (Atomic Energy Commission, New York). Dec 1974.

In plutonium and other transuranium elements.

Nuclear tests conducted in the atmosphere are the major sources of Pu contamination of the environment on a worldwide basis. About 320 kilocuries of ^{239}Pu have been deposited and about 4 kilocuries remaining in the stratosphere will reach the earth's surface. Measurements are being made of air concentrations at ground level and the deposition rate. Inhalation is the major route of human exposure. Contamination levels in foods have also been measured and the comparatively smaller body burden from ingestion is discussed. (CH)

16528 ENVIRONMENTAL ASPECTS OF NUCLEAR ENERGY PRODUCTION. Pigford, T. H. (Univ. of California, Berkeley). Annu. Rev. Nucl. Sci.; 24: 515-559(1974).

Data and estimates are presented to illustrate the enormous quantities of radioactivity associated with the fission products, neutron-activation products, and actinide elements and their decay daughters produced in nuclear fission reactors and processed in the nuclear fuel cycle. For nuclear power to be environmentally acceptable the fraction of this radioactivity that can be allowed to reach the environment as released radionuclides is extremely small. It is because there are well-developed and carefully implemented standards governing operational releases from the reactor and from all other operations in the nuclear fuel cycle, and because there are reliable technologies available to control releases to meet these standards, that the operation of nuclear power plants results in such little environmental impact from radioactive effluents. Analysis of additional environmental impacts from the wide spectrum of accidental releases that are theoretically possible is beyond the scope of the present review. (auth)

Atmosphere

Refer also to abstract 16561.

16529 (SCPRI(RM)–5-1974) MONTHLY PROGRESS REPORT. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). May 1974. 15p. (In French). Dep. NTIS (US Sales Only) $4.00.

This monthly report of the SCPRI presents an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk, plants, cattle, fish), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A monthly bibliographic selection is also presented. (FR)

16530 (SCPRI(RM)–5-1974(App.)) APPENDIX TO THE MONTHLY PROGRESS REPORT: DETAILS OF THE RESULTS OF MEASUREMENTS. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). May 1974. 25p. (In French). Dep. NTIS (US Sales Only) $4.25.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RM–5-1974 report) are presented. (FR)

16531 (SCPRI(RM)–6-1974) MONTHLY PROGRESS REPORT (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Jun 1974. 16p. (In French). Dep. NTIS (US Sales Only) $4.00.

This monthly report of the SCPRI presents an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk, plants, cattle, fish), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A monthly bibliographic selection is also presented. (FR)

16532 (SCPRI(RM)–6-1974(App.)) APPENDIX TO THE MONTHLY PROGRESS REPORT: DETAILS OF THE RESULTS OF MEASUREMENTS. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Jun 1974. 27p. (In French). Dep. NTIS (US Sales Only) $4.50.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RM–6-1974 report) are presented. (FR)

16533 FORMATION OF RADIOACTIVITY SIZE DISTRIBUTIONS IN NUCLEAR BOMB DEBRIS. Storeboe, B. (Norwegian Defence Research Establishment, Kjeller). J. Aerosol Sci.; 5: No. 6, 557-577(Nov 1974).

A theoretical study was made of droplet formation in hot vapor gradually cooled under admixture of air containing particles. Spontaneous nucleation, condensation on existing droplets, and coagulation are treated as simultaneous phenomena. Spontaneous nucleation takes place initially, but gives way to condensation on existing droplets. For nuclear ground explosions, site particles are present in the admixed air. Bomb debris is therefore composed of one particle group developed from spontaneous nucleation and another group strongly affected by admixed particles. Only the latter group contains particles large enough to produce close-in fallout. Its radioactivity size distribution is approximately the admixed particle–number size distribution weighted by linear size raised to a power between 1.1 and 1.5. (auth)

Soil

16534 (ORO-4700-1) ADSORPTION AND DIFFUSION OF Pu IN SOILS. Brown, D. A. (Arkansas Univ., Fayetteville (USA). Dept. of Agronomy). 20 Dec 1974. AT(40-1)-4700. 3p. Dep. NTIS $4.00.

Progress is reported on the following projects: development of special equipment for safe handling of Pu in adsorption and diffusion experiments; development of a manually operated cryostatic microtome for partitioning soil cores and of a large glove box for containing diffusion and radioassay instruments; completion of a temperature controlled plutonium laboratory including the necessary air sampling and alpha radiation monitoring systems; preparation of mineral samples of kaolinite, illite, and montmorillonite for adsorption and diffusion experiments; chemical characterization of soils and clays; and experiments on diffusion of ^{237}Pu and ^{238}Pu in salt solutions and in standard clay minerals. (HLW)

Water

16535 CESIUM 137 IN A MOUNTAIN STREAM CHANNEL. Hubbard, J. E.; Striffler, W. D. (Colorado State Univ., Ft. Collins). Water Resour. Res.; 9: No. 5, 1440-1442(Oct 1973).

Concentration of the radionuclide ^{137}Cs in water, sediment, and channel vegetation was determined in a Colorado mountain watershed in 1967. No measurable ^{137}Cs was found in stream water. Specific ^{137}Cs activity in sediment decreased exponentially with distance from the headwaters. Its concentration was 124 pCi/l at the headwaters, where a snowfield has existed continuously since the atmospheric testing of nuclear weapons, to 4 pCi/g 5,6000 m downstream. Stream vegetation samples also indicated a similar decrease in specific ^{137}Cs activity with site location downstream. (Pollut. Abstr.)

16536 LAND SURFACE EROSION AND RAINFALL AS SOURCES OF ^{90}Sr IN STREAMS. Menzel, R. G. (Dept. of Agriculture, Durant, OK). J. Environ. Qual.; 3: No. 3, 219-223(1974).

Strontium-90 concentrations in streams from 1958 to 1967 reflected the changing concentrations in rainfall and accumulation on the land surface. Correlation analysis of data from nationwide sampling networks shows that the ^{90}Sr concentration in streams was accounted for, on the average, by 1.7% of the rainout 2 months earlier, and annual erosion of 0.58% of the accumulated ^{90}Sr on the land surface. Direct runoff of ^{90}Sr in preceding rainfall was highest, 2.0 to 2.2%, in the north central and eastern United States, ranging down to no measurable direct runoff in the southwestern United States. Annual erosion of ^{90}Sr from the land surface ranged from 0.75% in the Ohio River Basin to 0.17% in the Missouri River Basin. If one allows for differences in time and area of application, these results for land surface erosion indicate the potential movement of persistent, strongly adsorbed pesticides from large land areas. (auth)

Ecosystems and Food Cycles

Refer also to abstracts 16552, 16560, 16796, 16892, 19148, 19153, and 19159.

16537 (AEC-tr-7590, pp 166-172) MIGRATION OF RADIOSTRONTIUM IN THE FODDER–COW–MILK CHAIN. Annenkov, B. N. Dec 1974. Translated from pp 154-160 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

With chronic administration of radiostrontium to cows with their fodder, 0.10 to 0.20% (mean of 0.142%) of the ^{90}Sr ingested per day is demonstrable in 1 liter of milk. In the course of a day, the mammary gland secretes 0.20 to 4.70% of the ^{90}Sr administered with the food in the same period of time. Total excretion of radiostrontium with milk is related to the level of secretory activity of the mammary gland. With addition of 400 grams $CaCO_3$ or replacement of herbaceous hay by leguminous hay in the cows' ration, there is a 20 to 35% decrease in amount of ^{90}Sr that passes into milk. The coefficient of ^{90}Sr discrimination in the milk–fodder link ranges on the average from 0.093 to 0.251. The magnitude of the discrimination coefficient is determined largely by the amount of stable calcium in the diet. After discontinuing administration of radiostrontium to cows, the concentration of this isotope in milk rapidly dropped at the first stage ($T_{eff}\approx 3$ days) and thereafter the decline proceeds at a slower rate ($T_{eff}\approx 100$ days). (auth)

16538 (AEC-tr-7596, pp 171-175) CONCENTRATION OF CESIUM-137 IN COMMERCIAL FISH OF THE ATLANTIC OCEAN, BALTIC, AND CASPIAN SEAS. Bakunov, N. A. (Caspian Scientific Research Inst. of the Fish Industry, Makhachkala, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 447-449(1974).

In Radiobiology.

In radioecological investigations, substantial attention is paid to problems of the migration and distribution of long-lived radionuclides in the biosphere, in particular, their transfer from marine organisms to the food of animals and man. Of definite interest in this respect is a comparative estimate of the level of contamination by cesium-137 of commercial species of fishes, inhibiting the open ocean and inland seas. Such an estimate is essential for determining the general radiation situation on the seas, the radioactive pollution of which has occurred for a long time primarily on account of global fallout of residual radionuclides from the atmosphere. (tr-auth)

16539 (TID-3910-S10) TERRESTRIAL AND FRESHWATER RADIOECOLOGY. A Selected Bibliography. Klement, A. W. Jr.; Schultz, V. (Washington State Univ., Pullman (USA). Dept. of Zoology). 1975. 124p. Dep. NTIS $5.45.

This is the ninth supplement to the bibliography on terrestrial and freshwater radioecology issued in March 1962. This compilation of some 1200 references is based on the same criteria as previous supplements and includes publications which have come to our attention since publication of Supplement 9. Volume 28 of Nuclear Science Abstracts was perused, and other references were obtained from a large number of sources. (CH)

16540 (WASH-1359, pp 131-152) ENVIRONMENTAL PATHWAYS OF TRANSURANIC ELEMENTS. Bennett, B. G. (Atomic Energy Commission, New York). Dec 1974.

In plutonium and other transuranium elements.

A large number of laboratory and ecological studies have been performed to elucidate specific aspects of these pathways, such as resuspension of deposited activity, plant uptake, and physical and biological transfers in terrestrial and aquatic environments. In addition, the measurements of fallout Pu, tracing the course of this material in air and diet to man, provide some of the most directly appropriate data regarding the environmental pathways. It is generally recognized that for an initially airborne release, the inhalation pathway is the dominant contributor to the body burden in man. The low solubility of the transuranic elements inhibits plant uptake and absorption from the gastrointestinal tract and minimizes the importance of the ingestion pathway. The physical mechanisms of transfer of activity are thereby emphasized instead of biological accumulation mechanisms. Dispersion of airborne radioactivity is governed by the local and regional meteorology. For contamination which originates on the ground surface, such as leakages or spills, resuspension could be an important consideration. (CH)

16541 (WASH-1359, pp 155-168) TRANSURANIC ELEMENTS IN THE MARINE ENVIRONMENT. Volchok, H. L. (Atomic Energy Commission, New York). Dec 1974.

In plutonium and other transuranium elements.

Transuranic elements have been introduced in dispersed form into the marine environment in: close-in fallout from nuclear explosives testing; world-wide fallout from nuclear explosives testing; atmospheric burn-up of ^{238}Pu power sources; and liquid wastes from chemical reprocessing plants and reactor operations. The environmental redistributions of Pu have been followed after its introduction by each of these avenues, and a small amount of information exists about Am. Unfortunately the data now at hand do not permit us to distinguish among the distributions of Pu following its introduction in different ways. Data are summarized on the content of ^{241}Am, ^{239}Pu, and ^{238}Pu in samples of seawater and sediments collected at various ocean depths and in samples of plankton, seaweeds, invertebrates, fishes, and mammals collected at various locations. (CH)

16542 ^{90}Sr AND ^{137}Cs CONTENT IN SOIL, GRAIN, FODDER, AND MILK FOR 1963–1971. Chupka, S.; Petrashova, M. (Regional Health Station, Bratislava). Sov. At. Energy (Engl. Transl.); 36: No. 3, 281-283(Mar 1974).

Translated from At. Energ. (USSR); 36: No. 3, 226-227(Mar 1974).

Samples of atmospheric precipitation, milk, wheat, and soil in the area around the atomic power station at Yaslova Bogunits were analyzed for ^{90}Sr and ^{137}Cs. Results indicated that the soil component dominates in the contamination of grain and the plant extracts from the soil predominantly ^{90}Sr. Similar conclusions were reached for alfalfa. The ratio of ^{137}Cs to ^{90}Sr in milk was 2.1; in atmospheric precipitation 1.6; in alfalfa 0.8; in soil 1.7; and in wheat 1.8. The overall reduction of ^{90}Sr and ^{137}Cs in precipitation was responsible for reduction of these isotopes in all parts of the food chain except the soil. (HLW)

Radiometric Techniques

Refer also to abstract 15977.

16543 (IAEA-R-702-F) HYDROSPHERIC ENRICHMENT OF MERCURY STUDIED BY ^{203}Hg-LABELLED ORGANIC COMPOUNDS. Final Report for the Period 1 December 1968–30 November 1971. Miettinen, J. K. (International Atomic Energy Agency, Vienna (Austria)). Jun 1972. vp. INIS.

^{203}Hg-labeled mercury compounds were used to study the fate and significance of mercury as a pollutant of marine and aquatic environments and as a contaminant of food chains. Inorganic Hg was demonstrated to undergo biological methylation. The excretion rate of administered labelled compounds varied with species, dose, and molecular form of the administered mercury. Approximately 94% of administered methylmercury was absorbed by the whole-body and showed an effective biological half-life of approximately 76 days; approximately 15% of inorganic mercury was absorbed and showed a half-life of approximately 42 days. (INIS)

16544 (IAEA-R-847-F) INVESTIGATIONS OF THE CONNECTION OF THE SUBSOIL WATER WITH UNDERGROUND WATER IN THE NILE DELTA (EGYPT) USING ISOTOPES. Final Report for the Period 1 December 1971–30 November 1972. Hazzaa, I. B. (International Atomic Energy Agency, Vienna (Austria)). Jul 1973. vp. INIS.

Environmental tritium and artificial tracers (^{131}I and ^{32}P) were employed to confirm the suspected hydraulic connection in the leaky aquifer system of the Nile delta and to measure the flow velocity and direction of flow in the upper sub-soil zone. (INIS)

16545 (IC-8627) WELL-LOGGING TECHNIQUES FOR MINERAL DEPOSIT EVALUATION: A REVIEW. Scott, J. H.; Tibbetts, B. L. (Bureau of Mines, Denver, Colo. (USA). Denver Mining Research Center). 1974. 48p. GPO $0.90.

Well-logging techniques used to evaluate various types of mineral deposits are discussed briefly, and many pertinent references are cited. Information is categorized by mineral commodity to make it easy to determine what logging techniques were used for evaluating specific metals and nonmetals. Part 1 discusses logging techniques applied to deposits of the following metals: aluminum, antimony, beryllium, boron, copper, iron, lead and zinc, manganese, mercury, nickel, silver and gold, tin, tungsten, and uranium. Part 2 covers the following nonmetals: coal, evaporites, fluorspar, oil shale, rock salt, and sulfur. Separate bibliographies are given for 176 English and foreign language references. (auth)

16546 NUCLEAR LOGGING METHODS IN MARINE GEOLOGY. Beckmann, H. (Technische Univ., Clausthal-Zelrfeld, Ger.); Abdullah, H. Ind. At. Spatiales; 18: No. 2, 35-48(Mar 1974). (In English and French).

Nuclear logging methods are applied in marine geology for several purposes, for mapping the sediments on the sea floor, for mapping deposits of heavy minerals and for purposes of coastal engineering. Most usual methods are logging natural gamma activity, logging the density of sediments by gamma/gamma probes and logging their water content by neutron/neutron or neutron/gamma methods. A combination of a gamma/gamma counter with a neutron/neutron probe was developed especially for heavy mineral exploration. A very complicated and sophisticated apparatus is under development for the in situ retarded neutron analysis of manganese nodules. Nuclear logging methods have mostly been used in combination with other bottom trail logs, containing acoustic, electric, optical or topographic system. Tandem operation of several systems on one trail probe is possible. Nuclear systems are generally used in tandem with acoustic or electric systems. (FR)

16547 EVIDENCE OF MULTIPLE INTRUSION, POSSIBLE RESETTING OF U–Pb AGES, AND NEW CRYSTALLIZATION OF ZIRCONS IN THE POST-TECTONIC INTRUSIONS ('RAPAKIVI GRANITES') AND GNEISSES FROM SOUTH GREENLAND. Gulson, B. L. (Commonwealth Scientific and Industrial Research Organization, North Ryde, Australia). Geochim. Cosmochim. Acta; 39: No. 1, 65-82(Jan 1975).

U–Pb data for zircons from post-tectonic monzonite, syenite, and norite, and country rock gneiss and migmatite from the Kap Farvel-Prins Christian Sund area of South Greenland indicate two distinct intrusive episodes at ~1740 and ~1755 m.y. The norites have the same age as the older granitic rocks. Similar intrusions further north along the southeast coast have the same age (~1755 m.y.) and geochemical character as those of the Kap Farvel-Prins Christian Sund area. The U–Pb ages are about 100 m.y. older than previously determined K–Ar ages. In one hypersthene migmatite sample collected near a post-tectonic intrusion, clear overgrowths and separate clear grains with low uranium concentrations were identified. The clear grains of zircon have the same age as the intrusion, indicative of new zircon growth during the granulite facies recrystallization of the gneiss. If the deep-red zircons observed in one of the post-tectonic intrusions were derived from the surrounding metamorphic rocks, they have had their U–Pb systems reset to the time of intrusion. In accord with observations (Krogh, Carnegie Inst. Wash. Yearb.; 70:258 (1971)) on non-magnetic zircon fractions from volcanics, the Greenland zircons contain very low amounts of common lead ranging from <0.01 ppM in the least magnetic fractions in the post-tectonic intrusions, to 6.5 ppM in the most magnetic fractions of the gneisses. These two rock groups can be differentiated on the basis of their common lead content. (auth)

16548 Io/U AGES OF CORALS FROM SAURASHTRA COAST. Gupta, S. K.; Amin, B. S. (Tata Inst. of Fundamental Research, Bombay). Mar. Geol.; 16: No. 5, M79-M83(Jul 1974).

Un-recrystallized fossil corals occurring at 2 to 6 m above the present mean low-tide level on the Saurashtra coast (Western India) were dated by ^{230}Th/^{234}U and ^{234}U/^{238}U radiometric methods. The measured ages of the corals, which are in agreement with radiocarbon ages, fall in three groups, 6,000, 30,000, and 120,000 years before present. This observation, coinciding with the high sea-level stands reported in several locations in the world, in the absence of evidence in support of instability of Saurashtra coast, suggests that the coral reefs are remnants of one Holocene and two Quaternary high-sea level stands. (NL)

16549 RELATIONSHIPS BETWEEN SEALEVELS, ^{18}O VARIATIONS AND ORBITAL PERTURBATIONS, DURING THE PAST 250,000 YEARS. Chappell, J. (Australian National Univ., Canberra). Nature (London); 252: No. 5480, 199-202(15 Nov 1974).

Sea level changes over the past 250,000 yr, determined from dated coral reefs on rising islands, are said to be synchronous with precessional changes in solar radiation when orbital eccentricity is large. Oxygen isotope variations in deep-sea cores correspond in timing, but not in amplitude, reflecting changing isotopic composition of Pleistocene icecaps. (auth)

16550 TWO USEFUL ISOTOPES: ^{87}Sr AND ^{86}Sr. Gill, J. B. (Department of Geology, University of California, Santa Cruz (USA)); Jakes, P. (Ustredni Ustav Geologicky, Prague (Czechoslovakia)). Geol. Pruzkum; 16: No. 2, 52-53(1974). (In Czech).

The geochemistry of Sr isotopes is presented as one of the possibilities of solving the genesis and origin of the magma. The discussion is focused on the problem of whether the magma is no more than the product of melting or whether it is the result of activation of the existing core of the Earth, whether it originates in the deeper parts of the Earth, or in the mantle. The reply to these questions is of much wider significance because it concerns the geological past and present of the Earth, the question of the increment of continents on the one hand and their sinking in the oceans on the other. (INIS)

16551 RANGE AND LIMITS OF APPLICATION OF THE POTASSIUM–ARGON METHOD OF GEOLOGICAL DATING (REVIEW). Balogh, K. (ATOMKI, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 373-387(1974). (In Hungarian).

The principles of the K–Ar method of geological dating are reviewed. The analytical techniques used in the method are described in some detail. (JSR)

Site Surveys

16552 (ANL-8149) ANALYSIS OF POPULATION, BIRTH, AND DEATH STATISTICS IN THE COUNTIES SURROUNDING THE BIG ROCK POINT NUCLEAR POWER STATION, CHARLEVOIX COUNTY, MICHIGAN. Grahn, D. (Argonne National Lab., Ill. (USA)). Jan 1975. Contract W-31-109-Eng-38. 35p. Dep. NTIS $4.00.

Allegations that changes in the frequency of infant mortality, cancer mortality, and immature births might be associated with releases of radioactive gases from the 75 MWe nuclear power station at Big Rock Point, Charlevoix, Michigan, are evaluated. The report examines the level of radiation exposures attributable to the station, the demographic and vital statistics of Charlevoix County and seven additional surrounding counties, and the implications of the allegations in view of existing knowledge of radiation effects. The allegations are not supported by this conjoint analysis of population and vital statistics. (auth)

16553 (ARH-2983) SOIL MOISTURE TRANSPORT IN ARID SITE VADOSE ZONES. Isaacson, R. E.; Brownell, L. E.; Hanson, J. C. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-2130. 102p. Dep. NTIS $5.45.

Soil moisture transport processes in the arid soils of the Hanford site are being evaluated. The depth of penetration of meteoric precipitation was determined by profiling fallout tritium at two locations where the water table is about 90 meters below ground surface. In situ temperatures and water potentials were measured with temperature transducers and thermocouple psychrometers at one of these locations to obtain thermodynamic data for identifying the factors influencing soil-moisture transport. Neutron probes were used to monitor soil moisture changes in two lysimeters, three meters in diameter by 20 meters deep. The lysimeters are also equipped to measure pressure, temperature, and water potential as a function of depth and time. Nonisothermal soil moisture transport processes are being studied. A thermal pump that moves water towards the surface exists as a result of annual sinusoidal oscillation of temperature in the upper nine meters of soil. A partially desiccated zone exists at a depth between 9 to 16 meters. Future work will be concerned with further study of these systems and the coupling of theoretical and experimental work and determining the amount of rainfall required to cause migration of soil moisture to the water table. (auth)

16554 (DOCKET-701372-4) GULF YOUNGSVILLE NUCLEAR FACILITY. An Archaeological Reconnaissance of the Proposed General Atomic Fuel Fabrication Facility Site, Franklin County, North Carolina. (Gulf General Atomic Co., San Diego, Calif. (USA)). 11 Oct 1974. 58p. Dep. NTIS $6.00.

An archaeological reconnaissance of 350 acres in the 1000 acre tract of the proposed General Atomic Fuel Fabrication Facility in Franklin County, N. C. recorded thirty-five prehistoric sites and seven historic sites. Of the forty-two sites, it was determined that twenty-four will be impacted by projected construction activity. Preliminary assessment of these sites, based in part upon analysis of the cultural material recovered, indicates that twenty-two merit further investigation. Test excavations are recommended for three of the sites, including 31 Fk 19, which yielded a fluted projectile point. It is also suggested that consideration be given to implementing plans for an archaeological reconnaisance of the remaining GAFFF site acreage. (auth)

16555 (DUN-1524) 1918 CORFU EARTHQUAKE. Fifer, N. F. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 7 Sep 1966. Contract A(45-1)-1857. 5p. Dep. NTIS $4.00.

Data available on the 1918 Corfu earthquake are summarized in relation to a study of the geology of the Hanford area. The data cast some doubt on the validity of the reported intensity and location of the epicenter of this earthquake. (CH)

16556 (NILU-TN-61/73) DRY DEPOSITION OF I-131 IN THE GRAZING SEASON. Sivertsen, B. (Norsk Institutt for Luftforskning, Kjeller). Oct 1973. 15p. (In Norwegian). Dep. NTIS (US Sales Only) $4.00.

Calculations were made of the deposition of ^{131}I on the ground, not including rainout, during the grazing season at four prospective nuclear power plant sites in the Oslofjord region, Norway. The calculations are based on given models for atmospheric dispersion, source strength etc., and on wind measurements at the sites and climatic data from nearby meteorological stations. (NO)

16557 (NILU-TN-61/73(Add.)) GROUND CONTAMINATION BY ^{137}Cs AND ^{90}Sr AFTER ONE YEAR OF OPERATION OF A NUCLEAR POWER PLANT BY THE OSLOFJORD. Sivertsen, B. (Norsk Institutt for Luftforskning, Kjeller). Nov 1973. 18p. (In Norwegian). Dep. NTIS (US Sales Only) $4.00.

Calculations of the ground contamination by ^{137}Cs and ^{90}Sr after one year of operation of a nuclear power station are presented for four prospective sites in the Oslofjord region. The results are presented on maps and an extrapolation up to ten years is shown in a figure. (NO)

16558 (NP-20276) BASELINE ECOLOGY OF THE LOWER CAPE FEAR RIVER ESTUARY AND OCEAN OFF OAK ISLAND, N. C., 1971-72. Second Annual Report. Copeland, B. J.; Birkhead, W. S. (North Carolina State Univ., Raleigh (USA)). 1 Jul 1973. 399p. North Carolina State Univ., Raleigh, NC.

For Carolina Power and Light Co., Raleigh, NC.

Results are reported from studies on the biota and hydrography of the Cape Fear River Estuary and adjacent near-shore ocean that were carried out to obtain baseline information for assessing any subsequent changes that may occur as a result of the construction and operation of the Brunswick nuclear power plant. Measurements were made of the salinity, temperature, and content of dissolved oxygen in water samples collected at various depths throughout 1971 and 1972. Data are presented on the species composition and seasonal variations in the population structure of phytoplankton, zooplankton, benthic, and nektonic organisms in relation to environmental characteristics and migration patterns in the Estuary. Significant organisms were selected for laboratory tests for assessing thermal tolerance. (CH)

16559 (NP-20277) DUTCHMAN CREEK ESTUARY, N. C., AS A NURSERY AREA. Annual Report. Copeland, B. J.; Birkhead, W. S. (North Carolina State Univ., Raleigh (USA)). 31 Jan 1973. 95p. North Carolina State Univ., Raleigh, NC.

For Carolina Power and Light Co., Raleigh, NC.

Carolina Power and Light Company is constructing a nuclear-powered generating plant in Brunswick County, N. C., adjacent to the Cape Fear River Estuary. Once-through cooling will be provided by circulating water from the Cape Fear River Estuary through the plant and discharging it to the ocean off Oak Island via a discharge canal. The discharge canal runs along the north and west side of a marsh surrounding a tidal creek, Dutchman Creek. Construction of the discharge canal and a parallel drainage ditch has intercepted three tributaries and the headwaters of Dutchman Creek. Because of the reported importance of Dutchman Creek as a nursery area for fish and shellfish and the construction of the effluent canal, a survey was made on the environmental impact on the estuary due to construction activities. Preliminary data are presented on the water temperature, salinity, content of organic carbon, and spatial and temporal distribution of plankton, fishes, molluscs, and crustaceans in the Dutchman Creek Estuary during 1971 and 1972. (CH)

16560 (NVO-409-2) ECOLOGY OF HOT CREEK VALLEY, NEVADA AND NONRADIATION EFFECTS OF AN UNDERGROUND NUCLEAR DETONATION. Tueller, P. T.; Bruner, A. D.; Everett, R.; Davis, J. B. (Nevada Univ., Reno (USA). Max C. Fleischmann Coll. of Agriculture). Sep 1974. Contract AT(26-1)-409. 51p. Dep. NTIS $5.45.

The vegetation on approximately 70 square miles of the north portion of Hot Creek Valley Nevada Test site was mapped using aerial photographs in conjunction with data from 108 ground macroplots. Soils and vegetation are described for each macroplot. Many areas in Hot Creek Valley have been disturbed by AEC contractors in their preparations for underground detonations. Revegetation of these areas has been studied. Species and three seeding method trials were evaluated to make revegetation recommendations. Changes in soil water potentials, soil and air temperatures, and relative humidity resulting from underground nuclear explosions accounted for significant variation in plant water potentials. The combined effect to two or three of these independent variables explained 70 to 90 percent of the variation in plant water potentials. Soil water potentials and soil temperatures found at the sites appear to be at the end points of the acceptable range for growth and maintenance of the plants. Only small variations in either parameter caused it to become the limiting soil factor in plant water potentials. (CH)

16561 (UCRL-75864) TERRESTRIAL GAMMA-RAY SURVEYS AT PREOPERATIONAL NUCLEAR POWER PLANTS USING AN IN SITU Ge(Li) SPECTROMETER. Ragaini, R. C.; Jones, D. E.; Huckabay, G. W.; Todachine, T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Dec 1974. 11p. (CONF-741213-3). Dep. NTIS $4.00.

From nuclear science symposium; Washington, District of Columbia, USA (11 Dec 1974).

As a prelude to in-situ measurements of γ exposure rates from reactor plumes, baseline terrestrial γ-ray surveys were made at five preoperational nuclear power stations: Fort St. Vrain, Colorado; Fort Calhoun, Nebraska; Cooper Nuclear Station, Nebraska; Rancho Seco, California, and Diablo Canyon, California. A pressurized ion chamber was used to measure the total exposure from cosmic rays and terrestrial radionuclides. A portable Ge(Li) spectrometer was used to make in-situ measurements of the radionuclide soil concentrations and of the individual external γ exposure rates at the TLD sites. Subsequent measurements after start-up will enable accurate determinations of deposition and buildup of reactor-produced fission products to be made. The application of the in-situ Ge(Li) spectrometer for real-time plume dose measurements is being investigated. (auth)

Thermal Effluents

16562 (BNWL-SA-5175) EFFECT OF TEMPERATURE ON TOLERANCE TO DISSOLVED GAS SUPERSATURATION OF BLACK BULLHEAD, ICTALURUS MELAS. Fickeisen, D. H.; Montgomery, J. C.; Hanf, R. W. Jr. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 12p. (CONF-741033-1). Dep. NTIS $4.00.

From workshop on gas bubble disease; Richland, Washington, USA (8 Oct 1974).

Black bullhead, Ictalurus melas, were acclimated to 8, 12, 16, and 20°C in Columbia River water, and were tested at each of the acclimation temperatures to determine acute tolerance to dissolved atmospheric gas tensions in excess of equilibrium saturation. The data were subjected to probit analysis and mean 96-hour TL_{50} values were 126.7% of equilibrium saturation at 8°C, 125.1% at 12°C, 123.8% at 16°C, and 124.4% at 20°C, indicating a slightly elevated tolerance at the lowest test temperature. These values, while indicating a statistically significant difference in tolerance, do not indicate an ecologically significant effect of temperature on acute tolerance of black bullhead in the range of temperatures tested. (auth)

16563 (NP-20290-P1) METEOROLOGICAL EFFECTS OF THE COOLING TOWERS AT THE OAK RIDGE GASEOUS DIFFUSION PLANT. I. Description of Source Parameters and Analysis of Plume Photographs and Hygrothermograph Records. Hanna, S. R.; Perry, S. G. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.). Dec 1973. 41p.

Measurements of source parameters, downwash criteria, visible plume dimensions, and water deposition rate, taken at the Oak Ridge Gaseous Diffusion Plant are presented. In some cases, such as the measurements of the initial droplet size distribution, comparisons are made with similar measurements taken by other groups. The most significant findings are listed in the summary at the end of the report. (auth)

16564 (NP-20290-P2) METEOROLOGICAL EFFECTS OF THE COOLING TOWERS AT THE OAK RIDGE GASEOUS DIFFUSION PLANT. II. Predictions of Fog Occurrence and Drift Deposition. Hanna, S. R. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.). Mar 1974. 40p.

The frequency of occurrence of fogs and the rate of deposition of chromate due to emissions from the cooling towers at the Oak Ridge Gaseous Diffusion Plant were calculated. Observations of drift deposition agree fairly well with calculated values. A detailed summary of significant findings is given at the end of the report. (auth)

16565 BASIC ELEMENTS OF ADEQUATE ENVIRONMENTAL REPORTS AND STATEMENTS. Jimeson, R. M.; Shuster, C. N. Jr. (Federal Power Commission, Washington, DC). AIChE Symp. Ser.; 70: No. 136, 817-829(1974).

The National Environmental Policy Act requires that an environmental statement be prepared before undertaking any major federal action significantly affecting the quality of the human environment. The elements required, the extent and depth of the diverse technical analyses needed for adequate treatment of environmental issues, and emerging policy trends are discussed. (auth)

16566 EPA'S VIEW OF WASTE HEAT CONTROL. Tichenor, B. A. (Pacific Northwest Environmental Research Lab., Corvallis, OR). AIChE Symp. Ser.; 70: No. 136, 425-429(1974).

A discussion of EPA's position on thermal discharges is presented, including the relevant legislative controls. The trend towards closed-cycle cooling systems is noted, and a discussion of the environmental and economic consequences of this trend is given. Data on the cost of thermal pollution control in the electric power industry are presented. (auth)

16567 CONTROL OF THERMAL DISCHARGES TO THE GREAT LAKES. Reynolds, J. Z. (Consumers Power Co., Jackson, MS). AIChE Symp. Ser.; 70: No. 136, 258-265(1974).

The effects and control of thermal discharges to the Great Lakes were studied using as an example the Palisades Nuclear Plant located on Lake Michigan. Included among the factors examined were: water temperatures; intake entrapment; entrainment effects; effects on benthic organisms; effects of the thermal plume on fish; the problem of attached algae; and the effects of chlorination. The paper concludes with a redefinition of the philosophy adopted regarding the control of thermal effluents. (ERB)

16568 EFFECT OF THERMAL EFFLUENT ON MIGRATING MENHADEN. Young, J. S.; Gibson, C. I. (USDC, Highlands, NJ). Mar. Pollut. Bull.; 4: No. 6, 94-96(Jun 1973).

Hot-water effluent from power stations kills juvenile Brevoortia tyrannus migrating through Long Island Sound. Because the fish sink to the bottom, losses are unrecorded or underestimated. Other fish are probably also affected. Menhaden in Long Island Sound contribute to the commercial fishery off the eastern seaboard of the U. S. At present the losses have little impact on the fishery, but if the projected increase in hot water discharges into the sound materializes, the consequences may be serious. (Pollut. Abstr.)

16569 DISSIPATION OF HEAT FROM A THERMAL EFFLUENT. Mumford, W.; Czapski, U.; Felon, M. (State Univ. of New York, Albany). Water Resour. Res.; 9: No. 6, 1565-1578(Dec 1973).

The relative magnitudes of surface cooling and lateral diffusion and advection from a thermal effluent are investigated. Data were gathered at Nine Mile Point, E of Oswego, New York. An estimate of the energy balance of the plume is made. The effective lateral diffusion coefficient obtained from the budget is larger than most values published. Surface cooling is suggested to be larger than that estimated by a Dalton type formula. An estimate of advection of sensible heat above the plume supports this suggestion. A modification of the temperature of the air over the plume is indicated by the data, although no increase in vapor pressure is observed. The variance of the vapor pressure in time and in space suggests a high degree of turbulence. (Pollut. Abstr.)

16570 POTENTIAL EFFECTS OF THERMAL DISCHARGES ON AQUATIC SYSTEMS. Welch, E. B.; Mar, B. W. (ACE, Seattle). Environ. Sci. Technol.; 8: No. 6, 561-568(Jun 1974).

Ecological changes in the aquatic environment caused by temperature increases are estimated to aid the decision process in siting cooling water discharges. Principal consideration is given to the fish community for which predictions of change in composition are based on lethal and preferred temperature. Six representative river systems in the country are considered: Columbia, Sacramento, Upper and Lower Mississippi, Tennessee, and Delaware rivers. Insufficient data precluded similar community response estimations for freshwater invertebrates. However, adequate protection of fish species results in like protection of the invertebrate fauna, and the estimated effect of elevated temperature on freshwater fish communities will suffice as a guideline for the protection of invertebrates. Similar predictions were not possible for the marine community since thermal requirements are known for only a few species. However, existing data and site studies are summarized for use as guidelines. (Pollut. Abstr.)

16571 UNSTEADY TEMPERATURE PREDICTION FOR COOLING PONDS. Yeh, G. T.; Verma, A. P.; Lai, F. H. (Ebasco Services Inc., New York). Water Resour. Res.; 9: No. 6, 1555-1563(Dec 1973).

The mixed Lagrangian and Eulerian approach is proposed to study the thermal and hydraulic performance of cooling ponds used mainly to dissipate the waste heat from power plants into the atmosphere. The hydraulic behavior of the cooling pond is analyzed by the Eulerian method, and the Lagrangian approach is used to study the thermal distribution. Isotime lines are obtained by numerically solving the governing hydrodynamic equations. The Lagrangian temperature is obtained by solving the energy equation either numerically with the 4th-order Runge-Kutta method or analytically with the linearization of the net heat flux at the water surface. The Lagrangian temperature is then converted to the Eulerian temperature through the isotime lines. This model is applied to predict flow patterns, isothermal lines, and discharge temperature for a cooling pond in the southwestern U. S. (Pollut. Abstr.)

Chemical Effluents

Refer also to abstracts 16045, 16079, 16521, 16558, 16563, and 16564.

16572 PROCEDURE FOR INCREASING THE TRANSPARENCY AND DECREASING THE BIOCHEMICAL OXYGEN CONSUMPTION IN WASTE WATER CONTAINING ORGANIC MATERIAL. Case, F. N.; Smiley, D. E. (to Energy Research and Development Administration). Norwegian Patent 128,868. 2 May 1974. Priority date 7 Oct 1969, USA. 5p. (In Norwegian).

Waste water from paper, cellulose, and textile plants contain organic materials such as lignin, organic dyes, and printing dyes, which are effective absorbers of light from the ultraviolet to the visible part of the spectrum. This reduces the photosynthesis process in the water and increases the biological oxygen demand (BOD). The process described consists of irradiation of the water, possibly with soluble hypochlorite additive, with a gamma dose of about 2.5 × 10^7 R under an oxygen-containing atmospheric pressure of at least 70 bar. (NO)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstracts 15969, 16916, and 18673.

General Detectors and Monitors

Refer also to abstracts 16561, 16913–16915, 16921, 16922, 16927, 16929, 16930, 16967, 16973, 16995, 16996, 17605, 18405, 18778, 18779, 18788, 18794, and 19029.

16573 (BARC-768, pp 159-160) STUDIES OF OPERATIONAL CHARACTERISTICS OF THE MULTI-ANGLE IONIZATION CHAMBER. Nadkarni, D. M.; Rama Rao, P. N.; Ajitanand, N. N.; Chaudhury, R. K.; Kapoor, S. S. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

16574 (CEA-Bib-210) HIGH-Z SEMICONDUCTOR NUCLEAR RADIATION DETECTORS FOR ROOM-TEMPERATURE GAMMA-RAY SPECTROMETRY. Bornand, B.; Friant, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Documentation). Nov 1974. 52p. (In French). Dep. NTIS (US Sales Only) $5.75.

A bibliographical search of high-Z semiconductor compounds used to replace germanium and silicon as detector elements operating at room temperature is presented. The three principal types of materials available for ionizing radiation spectrometry and dosimetry, also for activation analysis and x-ray fluoresence analysis are the following: cadmium telluride, gallium arsenide, and mercury iodide. The first part of this bibliography is established in synthetic form for preliminary studies from 1960 to 1970. The second part covers the 1971 to 1973 period, i.e., 123 references are given of articles and original reports together with their abstracts and indexes (subject-matter, author, and laboratory indexes including cited documents and periodicals). The following subjects are included: preparation of crystals, technology and fabrication, performance, and applications. (auth)

16575 (CEA-R-4598) STUDY AND REALIZATION OF AN ELECTROMETRIC DEVICE FOR AUTOMATIC MEASUREMENTS OF WEAK CURRENTS FROM STANDARD IONIZATION CHAMBERS. Roulet, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Dec 1974. 117p. (In French). Dep. NTIS (US Sales Only) $9.00.

Thesis. Submitted to Universite Scientifique et Medicale de Grenoble, France.

Dosimeter calibrations with standard ion chambers require accurate electrical current measurements above 10^{-15} ampere. A high-performance electrometric measuring system used for weak current measurements is outlined. The apparatus, consisting basically of a vibrating capacitor electrometer connected to normalized logic units, uses a capacitive integration method for the charge collection. The accuracy of this method depends essentially on the use of highly calibrated capacitors. The second part studies the performance of this electrometric system. Physical test results with ionization chambers show that this device allows very precise automatically repeated measurements of currents as weak as 10^{-14} ampere and with an accuracy better than 0.5%. Besides its utilization for dosimetric purposes, this measuring assembly can be used for any experimentation dealing with low currents generated by sources of very high internal resistance. (auth)

16576 (JINR-P13-8226) SEPARATION OF CATHODOLUMINESCENE FROM THE TRANSITION RADIATION BY DIFFERENT LUMINESCENCE DECAY TIME. Bogdzel, A. A.; Kobzev, A. P.; Rutkovski, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A device developed for the separation of the luminescence in the transition radiation experiments is described. The separation is being realized by means of the time distribution measurements of the light excited due to electron pulses. The time resolution of 2 to 4 nsec is obtained. The device has been developed in the Laboratory of Neutron Physics. (auth)

16577 (JINR-P13-8265) BEHAVIOR OF THE SURFACE-BARRIER DETECTORS IN THE IONIZED GAS. Bacho, I.; Kushniruk, V. F.; Pazhit, A.; Rykhlyuk, A. V.; Kharitonov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Behavior of the different types of surface-barrier detectors in ionized gas was investigated. The results obtained are well explained by the assumption of the positive or negative charge absorption on the detector surface. Shielding of the p-n junction edge conserves the detector characteristics when radiating. The detectors of p-type silicon are also of higher stability. (auth)

16578 (JINR–P13-8268) XENON STREAMER CHAMBER AND A HELIUM CHAMBER WITH XENON ADMIXTURES. Busso, L.; Kulyukin, M. M.; Lyashenko, V. I.; Nguyen Minh Kao; Piragino, G.; Pontekorvo, D. B.; Scrimaglio, R.; Troshev, T. M., Falomkin, I. V.; Shcherbakov, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The characteristics of a helium streamer chamber with small admixtures of xenon have been investigated. It was shown that these admixtures improve the chamber operation and widen the available range of pressures. It was also shown that a xenon streamer chamber works. Tracks of electrons have been photographed in the streamer chamber filled with pure xenon up to 150 torr. (auth)

16579 (JINR–P13-8383) INFLUENCE OF SOME GAS MIXTURES ON THE DRIFT CHAMBER OPERATION. Astabatyan, R. A.; Zanevskii, Yu. V.; Peshekhonov, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Characteristics of an argon drift chamber with different partial admixtures of methane, carbon dioxide, and isobutane are presented. The investigations were carried out using a β^--source under laboratory conditions. (auth)

16580 (KFTI–74-4) FAST LOGIC CIRCUITS FOR MULTICHANNEL COUNTERS OF CHARGED PARTICLES. Denyak, V. I.; Nemashkalo, A. A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1974. 17p. (In Russian). INIS.

A fast logic circuit developed for multichannel counting of charged particles is described. The circuit consists of integrated fast-acting 50-MHz elements. The basic characteristics of the circuit and three variations of the circuit for different types of multichannel counters are given. (tr-auth)

16581 (NIIAR-P–209) ABSOLUTE AND RELATIVE CALIBRATION OF Ge(Li) SEMICONDUCTOR DETECTORS. Ivanov, V. B.; Lyadov, G. D.; Shipilov, V. I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1973. 26p. (In Russian). INIS.

Experimental results are presented on determining the absolute counting efficiency and relative calibration of a series of Ge(Li) planar and coaxial detectors for various source-detector distances in the energy range of 100 to 3500 keV. The relative calibration was carried out by means of the isotopes antimony-125, solver-110m, europium-152 and cobalt-56. (tr-SJR)

16582 (WANL-TME-234) DEFINITIONS OF TERMS FOR NEUTRON DETECTOR SPECIFICATIONS. Ramp, R. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Dec 1962. 2p. Dep. NTIS $4.00.

A list of definitions of terms for neutron detector specifications is presented with reference to Action Item No. 358 of the minutes of the technical direction meeting at WANL on Nov. 1–2, 1962. (WHK)

16583 (WANL-TME-643) WANEF OPERATING LIMITS, MODIFICATION NO. 1. Battery Voltage Supplies for WANEF Ion Chambers. Kovacik, W. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Dec 1963. 6p. Dep. NTIS $4.00.

A change to the Westinghouse Astronuclear Experimental Facility (WANEF) Operating Limits has become necessary for operational reasons. The change has been reviewed and approved by the WANL Nuclear Safety Committee and is presented herein as required by Section III D 3 of WANL-TME-383, WANEF Operating Limits, and Chapter 7, Section 7.4.1a of WANL-TNR-099, WANEF Safety Report. The present voltage supplies for the PAX/PTX ion chambers will be replaced with equivalent dry cell batteries. (auth)

16584 INFRARED SPECTROSCOPIC STUDY OF THE INTERACTION OF HEAVY IONS WITH CELLULOSE TRIACETATE. Moliton, J. P.; Vareille, J. C.; Teyssier, J. L. (Univ., Limoges, France). Rev. Phys. Appl.; 9: No. 4, 731-741(Jul 1974). (In French).

Infrared spectroscopy was used to study radiation damage effects on solid state track detectors bombarded with Kr^{3+} ions (1 MeV/nucleon). Cellulose triacetate films, produced by a method developed in our laboratory were used. It is shown that the three kinds of C–O bonds contained in the cellulose triacetate molecule are affected, according to their types, by different irradiation fluences, the latter varying by steps of 2×10^{12} ions/cm^2. (FR)

16585 GEIGER–MUELLER COUNTER TUBE INPUT CIRCUIT. Draghicescu, M.; Iliescu, V. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 8, 827-837(1974). (In Rumanian).

A study of the circuits for Geiger–Mueller counter tubes, mainly of the input circuit, was made. The influence of the load elements on the counter tube parameters is analyzed and the performance obtained with the whole counter tube-load system are discussed. (auth)

16586 SPECIFICATION AND PERFORMANCE OF ON-SITE INSTRUMENTATION FOR CONTINUOUSLY MONITORING RADIOACTIVITY IN EFFLUENTS. New York; Inst. of Electrical and Electronics Engineers, Inc. (1974). 16p. (ANSI-N-13.10-1974; ICONS-01923).

This standard provides recommendations for the selection of instrumentation specific to the continuous monitoring and quantification of radioactivity in effluents released to the environment. The effluent streams considered may contain radioactive gases, liquids, particulates, or dissolved solids singly or in combination. This standard specifies detection capabilities, physical and operating limits, reliability, and calibration requirements and sets forth minimum performance requirements for effluent monitoring instrumentation. Unless otherwise specified, the criteria herein refer to the total system. This standard applies only to monitoring during routine operation that includes abnormal releases. Emergency situations, where additional performance capability will be required, are a matter of separate consideration. Also outside the scope of this standard are sample extraction and laboratory analyses, normally used for intercomparison between monitor calibrations and laboratory analyses, and other applications for continuous monitoring instrumentation such as environmental monitoring or process control. Sampling techniques are covered in ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities. (auth)

16587 TOMOGRAPHIC IMAGING DEVICE. Muehllehner, G. (to Nuclear-Chicago Corp.). US Patent 3,852,603. 3 Dec 1974. Filed date 24 Aug 1973. 10p.

An Anger-type radiation detector caused to precess in a circle with synchronous rotation of a slanted multichannel collimator to produce a tomographic image of the distribution of radionuclides throughout an object is described. One plane through the object is imaged in-focus without manipulation of the coordinate output signals from the detector, and other planes are imaged by adding appropriate sine and cosine functions of the system's angular orientation to the coordinate output signals before displaying the signals on a cathode ray tube. (Official Gazette)

16588 COMPUTER PROCESSING OF DYNAMIC IMAGES FROM AN ANGER SCINTILLATION CAMERA. Conference Held in St. Louis, Missouri, January 18–22, 1971. Larson, K. B.; Cos, J. R. Jr. (eds.). New York; Society of Nuclear Medicine, Inc. (1974). 223p. (CONF-710125-).

The proceedings of a workshop to explore the use of the gamma camera and other imaging devices in dynamic radiotracer studies are presented. The workshop was intended to provide specialists in nuclear medicine, nuclear instrumentation, and computer engineering with information on aspects of camera-computer interface design for dynamic imaging using the Anger camera. Information is presented on the physical principles and electronic design aspects of gamma cameras and on logic and interface design fundamentals relating to the processing of dynamic image data from such devices. Also, mathematical models for design and interpretation of dynamic tracer experiments and the statistical analysis of the data from these experiments are discussed. (WHK)

16589 INTEGRATED CIRCUIT PILE-UP REJECTOR. Daniels, C. J. (Naval Research Lab., Washington, DC). Rev. Sci. Instrum.; 46: No. 1, 102-103(Jan 1975).

The pile-up circuit described has been tested at random rates to 80,000 pps with a pulse pair resolution of 20 nsec. The unit features integrated circuits for decision-making logic. (auth)

16590 AUTOMATIC SCANNING OF MICE TRACK RECORDERS. Cohn, C. E.; Armani, R. J. (Argonne National Lab., IL). Rev. Sci. Instrum.; 46: No. 1, 18-19(Jan 1975).

A computer-controlled microscope system previously developed for scanning plastic solid-state track recorders has been refined to allow scanning of mica recorders. Refinements were made in the automatic focusing, scan pattern, and light level threshold. (auth)

16591 THIN FILMS FOR X-RAY ASTRONOMY. Williamson, F.; Maxson, C. W. (Univ. of Wisconsin, Madison). Rev. Sci. Instrum.; 46: No. 1, 50-52(Jan 1975).

A method is described for producing thin, large area plastic films used for entrance windows of x-ray proportional counters in rocket-borne experiments. Sizes up to 1800 cm^2 have been successfully prepared and flown. (auth)

16592 INSTRUMENTATION IN NUCLEAR MEDICINE. Volume 2. Hine, G. J.; Sorenson, J. A. (eds.). New York; Academic Press, Inc. (1974). 597p.

Separate abstracts were prepared for the 15 chapters included. (WHK)

For abstracts of individual papers see: 15974, 16593–16603, 16706, 16900, and 17767.

16593 ADVANCES IN SCINTIGRAPHIC INSTRUMENTS. Hine, G. J. (Veterans Administration, Washington, DC); Erickson, J. J. pp 1-59 of Instrumentation in Nuclear Medicine. Vol. 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

The recent mechanical and electronic developments in radioisotope scanners and gamma cameras are reviewed. (56 references.) (WHK)

16594 TOMOGRAPHY AND OTHER DEPTH-DISCRIMINATION TECHNIQUES. Anger, H. O. (Univ. of California, Berkeley). pp 61-100 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

Equipment and techniques for radiographic and radionuclide tomography are reviewed. (48 references.) (WHK)

16595 COMPUTERIZED MULTI-CRYSTAL SCINTILLATION GAMMA CAMERA. Grenier, R. P. (Baird-Atomic, Inc., Bedford, MA); Bender, M. A.; Jones, R. H. pp 101-134 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

The principles of operation and performance of a computerized multi-crystal gamma camera system are described. (WHK)

16596 RECENT DEVELOPMENTS IN POSITRON SCINTIGRAPHY. Brownell, G. L.; Burnham, C. A. (Massachusetts General Hospital, Boston). pp 135-159 of Instrumentation in Nuclear Medicine. Vol. 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

Recent techniques devised to circumvent limitations in the design of early positron cameras are detailed. (WHK)

16597 ON-LINE COMPUTER SYSTEMS FOR SCINTIGRAPHIC DATA PROCESSING. O'Neill, W. J. (Medical Data Systems Corp., Detroit); Sorenson, J. A. pp 203-227 of Instrumentation in Nuclear Medicine. Vol. 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

Computer hardware and software for the collection and processing of data from scintillation gamma cameras are reviewed. Specific characteristics of various commercial systems are summarized in an appendix. (WHK)

16598 SCINTIGRAPHIC DATA PROCESSING. Pizer, S. M.; Brownell, G. L.; Chesler, D. A. (Massachusetts General Hospital, Boston). pp 229-262 of Instrumentation in Nuclear Medicine. Vol. 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

The principles of various types of data collection, image processing, and image display devices and procedures for scintigraphy are reviewed. (WHK)

16599 QUANTITATIVE MEASUREMENT OF RADIOACTIVITY IN VIVO BY WHOLE-BODY COUNTING. Sorenson, J. A. (Univ. of Wisconsin Medical Center, Madison). pp 311-348 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

A general discussion of quantitation by whole-body counting is presented with emphasis on the effects of radionuclide distribution and patient thickness on recorded counts. The first session is an analysis of attenuation and distribution effects in different counting geometries. Section II presents a discussion of various corrective methods that are employed to minimize distribution and attenuation effects. The third section describes a group of whole-body counters of recent design. (WHK)

16600 TRANSMISSION SCANNING TECHNIQUES. Sorenson, J. A.; Cameron, J. R. (Univ. of Wisconsin Medical Center, Madison). pp 349-384 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

Transmission scanning techniques using monochromatic radionuclide sources and scintillation detectors which are employed to obtain images of internal patient anatomy and quantitative information about body composition and thickness are reviewed. The basic principle is the same as in radiography: different body substances, such as muscle, fat, and bone, attenuate radiation by differing amounts, and the amount and locations of these substances within a patient may be determined by transmission measurements. There are important differences in techniques, however, which make transmission scanning more suitable than radiography for some purposes. In transmission scanning, a radionuclide source emitting monochromatic radiation is used rather than an x-ray tube. The monochromatic beam has constant and well-defined attenuation characteristics and is not subject to beam hardening as is the heterochromatic beam from an x-ray tube. Also, the output is constant in quality and intensity except for statistical fluctuations and source decay. The radiation detector is a scintillation detector, usually NaI(Tl), instead of a film. This allows accurate quantitation of transmission data by photon counting techniques and avoids the nonlinearities and nonreproducibility of response that are encountered with film. (WHK)

16601 PROFILE SCANNING. Tothill, P. (The Royal Infirmary, Edinburgh). pp 385-405 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

The basic aim of profile or linear scanning is a one-dimensional determination of the radioactivity in a subject. A detector, collimated to receive radiation from a transverse section of the body, moves in a direction parallel to the long axis of the subject. The count rate along this axis provides a profile of the radioactivity distribution. The counter design and characteristics, methods of calibration and calculations, and applications are reviewed. (WHK)

16602 MINIATURE SEMICONDUCTOR RADIATION DETECTORS. Takayanagi, S. I. (Toshiba Research and Development Center, Kawasaki, Japan); Iio, M. pp 485-508 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

The design, construction, performance, and clinical uses of catheter semiconductor detectors are discussed. (WHK)

16603 RECENT DEVELOPMENTS IN THE LIQUID SCINTILLATION TECHNIQUE. Rapkin, E. (Intertechnique, Plaisir, France). pp 509-547 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

Automatic instrumentation is reviewed including front-end electronics, multichannel spectral analysis, preadjusted counting windows, external standardization, quench correction, constant efficiency operation, selection of group parameters, refrigeration, sample handling mechanisms, on-line data treatment, and data presentation. The Intertechnique Model SL20 and the Beckman β-Mate single-sample counters are described. Also, sample preparation techniques are discussed. (WHK)

16604 INSTALLATION WITH LOW BACKGROUND FOR THE MEASUREMENT OF THE ALPHA AND BETA RADIOACTIVITY. Sirbu, M. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 5, 551-556(1974). (In Rumanian).

An installation with low background for the measurement of the alpha and beta radioactivity is described. The background for the first group of Phillips GM counters (18,515 + 18,518) is (2.1 ± 0.13) p/min and for the second group of counters (18,516 ± 18,518) is (1.3 ± 0.1) p/min. It presents also the results of measurements obtained with this installation in the case of 15 types of underground waters, of halogens of potassium, some types of glasses, and one type of mica. (auth)

16605 TESTING RADIOMETERS OF NATURAL RADIOACTIVE AEROSOLS. Antipin, N. I.; Kolerova, O. N.; Kuznetsov, Yu. V.; Ruzer, L. S. Meas. Tech. (USSR) (Engl. Transl.); 17: 1074-1075(Jul 1974).

Translated from Izmer. Tekh.; 17: No. 7, 59-60(Jul 1974).

The aerosol radiometers were tested by means of a reference aerosol radiometer provided with reference 2nd grade ^{226}Ra isotope α sources, a generator of natural radioactive aerosol, barrel-type gas meters with a liquid lock; reference 2nd grade ^{239}Pu isotope α sources; and a timer. The All-Union Scientific-Research Institute of Physicotechnical and Radiotechnical Measurements has recently developed and made a model of an aerosol α-spectrometer type AS-1M for testing aerosol radiometers. Discrimination levels are set by means of a reference isotope ^{226}Ra spectrometric α source. The concentrations of RaA, RaB, and RaC in air and latent energy E_α are determined by the number of recorded pulses from RaA and RaC′. The basic aerosol α spectrometer characteristics comprise the energy resolution by means of the ^{239}Pu peak not exceeding 5%, and α particles recording efficiency not less than 8.5%. (WHK)

16606 MEASUREMENT OF PULSED NEUTRON FLUXES. Mitel'man, M. G.; Rozenblyum, N. D.; Alekseev, N. M.; Musatov, A. A.; Perederii, I. M.; Gusarov, A. K.; Zagadkin, V. A.; Belavin, M. Yu.; Sokolov, A. P. Sov. At. Energy (Engl. Transl.); 36: No. 3, 268-270(Mar 1974).

Translated from At. Energ. (USSR); 36: No. 3, 217-219(Mar 1974).

The response, sensitivity, timing properties, and design are compared for the activation-type direct charge detector and the Compton-type direct charge detector for in-core neutron flux measurements. The activation-type detector is based on collection of beta particles from transmuted nuclei, and the Compton-type detector collects Compton electrons and photoelectrons produced in the interaction of gamma rays from the (n,γ) reactions with the emitter. (WHK)

16607 METROLOGICAL INVESTIGATION OF METHODS FOR MEASURING CONCENTRATIONS OF ULTRAHIGH-DISPERSED AEROSOLS OF RADON DAUGHTER PRODUCTS. Dokukina, B. L.; Polev, N. M.; Ruzer, L. S. Meas. Tech. (USSR) (Engl. Transl.); 17: No. 7, 1076-1077(Jul 1974).

Translated from Izmer. Tekh.; 17: No. 7, 60-61(Jul 1974).

A method for measuring the activity of precipitated ultrahigh-dispersed radioactive aerosols directly with a diffusion battery for investigating the physics of aerosols and for testing air samplers is described. (WHK)

16608 PULSE IONIZATION CHAMBER FOR FISSION FRAGMENT COUNTING. Borcea, C.; Marinescu, L.; Petrascu, M.; Simion, V.; Voiculescu, G. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 5, 557-562(1974). (In Rumanian).

The construction, function and performances of a pulse ionization chamber for the detection of fission fragments is described. The chamber has proved to have a very good resolution and an extremely low background allowing its use for absolute fission cross-section measurements. (auth)

16609 ALPHA-BETA AEROSOL MONITOR WITH PSEUDO-COINCIDENCE COMPENSATION OF NATURAL RADIOACTIVITY. Hajek, P.; Horyna, J.; Vidra, M. (Inst. of Nuclear Research, Rez, Czech.). Jad. Energ.; 20: No. 11, 375-378(Nov 1974). (In Czech).

The detection of artificial radioactive emitters in air is complicated by the fact that levels of natural activity are frequently larger than those permissible for artificial emitters. In contrary to commonly used electronic circuits, delayed alpha particle pulsed open the gate of coincidence circuits. The influence of random coincidences at elevated beta or gamma pulse rates is compensated. Concentrations of 2 pCi/m^3 of ^{239}Pu and 300 pCi/m^3 of ^{90}Sr + ^{90}Y is detected and may trigger an alarm after 6 to 60 hours and 3 to 9 hours, respectively according to natural activity background level. (auth)

16610 NEW TYPES OF LIQUID SCINTILLATORS. Spruny, F. (Lab. for Radiological Dosimetry, Prague). Jad. Energ.; 20: No. 11, 372-374(Nov 1974). (In Czech).

Scintillation characteristics of some new types of liquid scintillators produced in the CSSR were studied. The full range of $\overline{\text{p}}$-xylene-based scintillators is depicted, the properties of new activator, 2-(4′-t-butylphenyl)-5-(4″-biphenyl)-1,3,4 oxadiazole (t-butyl-PBD) are given. The main advantage of $\overline{\text{p}}$-xylene based scintillators is in their high relative photon yields (up to 80% relatively to anthracene), and t-butyl-PBD displays outstanding fluorescence properties combined with excellent solubility. (auth)

16611 SMOOTHING OF CONTOUR RADIOMETRIC MEASUREMENTS AT A HIGH LEVEL OF FLUCTUATION NOISE. Savinskii, I. D.; Ostrovskii, E. Ya.; Blashchinskii, V. S. Sov. J. At. Energy (Engl. Transl.); 35: No. 3, 828-829(Sep 1973).

Translated from At. Energ. (USSR); 35: No. 3, 189-190(Sep 1973). This is a summary of paper No. 684/6996 with full copy held at TIC.

Using as an example of the smoothing of model curves involving known effective signals and noise, and representing the most important in the field of radiometric surveys, the iteration procedure is compared with the method of curve reconstruction by a truncated Fourier series and the slipping average technique with a reiterated smoothing procedure. The results obtained attest to the fact that the smoothing operation allows one to reduce by two to three times the root-mean-square deviation between the effective signal curve and the recorded curve. (WHK)

16612 MONTE CARLO CALCULATION OF THE ESSENTIAL FEATURES OF BREMSSTRAHLUNG DETECTION. Pokrovskii, A. V.; Tarasov, G. P. Sov. J. At. Energy (Engl. Transl.); 35: No. 3, 829(Sep 1973).

Translated from At. Energ. (USSR); 35: No. 3, 191(Sep 1973). This is a summary of paper No. 685/7004 with full copy held at TIC.

In the present article we present an algorithm and the results of calculations of several integral characteristics of a radiation detection technique which uses a scintillation detector shielded by an opaque collimator. We examined both monoenergetic sources (^{137}Cs, ^{60}Co) as well as a bremsstrahlung source (E_{max} = 6 MeV); point perpendicular, conical, and disk geometries were used, in each case homogeneous. A cylindrical NaI (Ta) detector was used. The source and detector were separated by a plane layer of absorber (iron). The quantities which were calculated were the energy of the radiation impinging on the crystal, the energy dissipated by the crystal, and the cutoff level of the radiation scattered in the absorber (the ratio of the energies at the output of the collimator). The rms relative error in the calculations averaged between 3% and 6%. The migration in the absorber was modeled by a specially chosen chain in order to sample the important trajectories. The characteristic difference between the algorithm considered here from those already known lies in the fact that here one initially develops the overall direction angles of the new transition, and subsequently determines the cosine of the angle of the change of direction (from which one calculates the new value of the quantum energy). (auth)

16613 HIGH-TEMPERATURE NEUTRON DETECTORS CONTAINING IRON, NICKEL, AND COBALT. Kolomiitsev, M. A.; Amoardanishvili, T. S.; Kiknadze, G. I.; Zakharina, T. Ya.; Dundua, V. Yu.; Brovkina, I. G. Sov. J. At. Energy (Engl. Transl.); 35: No. 3, 830(Sep 1973).

Translated from At. Energ. (USSR); 35: No. 3, 191(Sep 1973). This is a summary of paper No. 686/7110 with full copy held at TIC.

Iron, cobalt, and nickel detectors are widely used to measure neutron densities and integrated neutron fluxes. These detectors are generally pure metal foils or homogeneous mixtures of neutron-sensitive elements with matrices of aluminum and magnesium oxides and polyethylene which are weakly activated by neutron bombardment. An activity of the isotope formed in the irradiation of the detector sufficient for radiometric measurement can frequently be obtained with less than 10^{-4} to 10^{-5} g of the element per detector. The article discusses the special features of the manufacture and the main characteristics of activation detectors based on the mixing of an alcoholic solution of a phenolformaldehyde resin (PFR) and an alcoholic solution of the nitrate of the metal, with a subsequent conversion of the true solution obtained into polymeric tablet monitors. This method of manufacture eleminates most of the disadvantages of earlier methods and permits an extension of the range of control of the concentration of the neutron-sensitive element in the matrix from 1 to 10^{-8}%. (WHK)

16614 SEMICONDUCTOR CAMERA FOR DETECTION OF SMALL TUMORS. Profio, A. E.; Cho, Z. H. (Univ. of California, Los Angeles). J. Nucl. Med.; 16: No. 1, 53-57(Jan 1975).

Early detection of small tumors (approximately 3 mm) with only a moderate uptake ratio is often difficult because of poor statistics and a small signal-to-background ratio. The detection capability of a germanium semiconductor camera is analyzed to show that a very large number of counts is required even when the spatial resolution is matched to the size of the tumor. A potential enhancement of statistics using the tissue-scattered gamma rays is discussed based on the superior energy resolution of the semiconductor. (auth)

16615 COMBINED DETECTORS. Chapter 5. Mandel'tsvajg, Yu. B. pp 104-115 of Semiconductor Detectors in Ionizing Radiation Dosimetry. Lyapidevskij, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

The peculiarities and the optical and dosimetric characteristics of combined detectors (detectors in which the luminescence of luminophors are registered by semiconductors in optical contact with them) are examined. The process of light transmission in the combined detectors is examined. (INIS)

16616 PHYSICAL PROCESSES IN THE DETECTOR SENSITIVE VOLUME. Chapter 2. Lyapidevskij, V. K. pp 29-49 of Semiconductor Detectors in Ionizing Radiation Dosimetry. Lyapidevskij, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

The following physical processes occurring in the sensitive volume of a detector during its irradiation are examined: formation of free carriers, recombination and capture, transfer of the charge carrier, effect of strong electric fields on the concentration of free carriers, and carrier mobility. The variation in the properties of semiconductor detectors under the effects of x and γ radiation are described. (INIS)

16617 EXTRINSIC SEMICONDUCTOR DETECTORS. Chapter 4. Krongauz, A. N.; Podgornyj, V. N. pp 65-103 of Semiconductor Detectors in Ionizing Radiation Dosimetry. Lyapidevskij, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

The characteristics and peculiarities of non-homogeneous semiconductor detectors are described. They are classified by structure into semiconductor detectors with p-n, p-i-n, n-p-n (p-n-p) transitions; by method of preparation of p-n transition into surface-barrier or diffusion detectors or detectors with ion alloying, diffusion drift, and alloy; by principle of operation into detectors without amplification, with proportional amplification, and with avalanche amplification. At the present the practical use in dosimetry is obtained with Si and GaAs semiconductor detectors. Ge detectors are used in laboratory conditions at low temperatures. CdTe, GaP, and SiC based detectors are in the development stage. (INIS)

Radiation Dosimeters

Refer also to abstracts 16488, 17766, and 18117.

16618 (BNWL-B-11) RECOMMENDED PRECISION SPECIFICATION AND AUDIT TEST FOR THE HANFORD BASIC THERMOLUMINESCENCE DOSIMETRY PROCESS. Beetle, T. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1970. Contract AT(45-1)-1830. 9p. Dep. NTIS $4.00.

Results of a study to develop a precision specification and audit test for the Hanford Basic Thermoluminescence Dosimetry Process are presented. Measurements for which the precision specification is meant to apply are restricted to a range of radium gamma exposures between 50 mR and 1,000 mR. The specification allows for varying relative precision of 100% at the lower end of the range to 20% at the upper end of the range. It is recommended that thirty audit dosimeters should be exposed during each audit period. Of these, fifteen will be identified to the processor as audit dosimeters, and fifteen will be submitted to the processor as a blind audit. The purpose of the audit will be to ascertain whether or not the process is in control at the time of processing of personnel dosimeters. (WHK)

16619 (INIS-mf-1269) DESIGN AND CONSTRUCTION OF A PERSONNEL RADIOACTIVITY DOSIMETER. Romero, P. E. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Ingenieria Mecanica y Electrica). 1973. 87p. (In Spanish). INIS.

Thesis.

A personal radioactivity dosimeter using a G-M tube as a detector was designed and constructed. It can be carried in the pocket of a purse or of work clothing. The basic purpose of the dosimeter is indicating to the individual that he is exposed to a radiation field by means of an acoustic alarm when a certain exposure dose is passed. In the case of this dosimeter it is 3, 10, 30, and 100 mR/hr. The electronic circuits for the device were tested. (tr-auth)

16620 (RN-TM-0416) DESIGN, OPERATION, AND SELECTION CRITERIA FOR XE CALORIMETRIC NUCLEAR RADIATION DETECTORS. Samuelson, R. D. (Aerojet-General Corp., Sacramento, Calif. (USA)). Feb 1967. 24p. Dep. NTIS $4.25.

A calorimetric radiation detector design that can measure radiation environments adjacent to Aerojet-supplied XE hardware is recommended. In establishing criteria for calorimeter selection, a survey of several calorimeter designs was conducted. The survey failed to disclose any commercial "off-the-shelf" calorimeters designed for nuclear radiation detection and indicated that previous requirements have been satisfied by instruments fabricated in-house. Several calorimeter designs were analyzed to determine their suitability. The results of these analyses and resulting recommendations are presented. (auth)

16621 (SAND-74-0213) APPLICATIONS OF THE POLY (HALO)STYRENE DOSIMETER SYSTEM IN PULSED AND STEADY-STATE ENVIRONMENTS. Snow, E. T.; Benson, J. L.; Plimpton, J. D.; Bishop, W. P.; Royer, E. P. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 9p. Dep. NTIS $4.00.

Performance characteristics of the doped poly(halo)styrene dosimeter system are briefly reviewed. The material has proven to be an accurate totally-stopping fluence monitor in x-ray beams, giving excellent agreement with other measurements and with calculations. Dose-vs.-depth measurements using both stacks of films and solid plugs or wedges have been successful, survival in pulses of over 30 mrads has been observed, and dose-rate independence to over 10^{15} rads/sec has been confirmed. Calculations for minor readout corrections necessitated by multiple-reflection phenomena and for photon loss by fluorescence in x-ray applications are discussed briefly. Preliminary investigations showing no observable LET effects with 2-MeV protons are noted and other developmental applications are discussed. (auth)

16622 (WANL-TNR-077) NEUTRON AND GAMMA DOSIMETRY FOR IRRADIATION TESTING. Tubbs, D. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1962. 26p. Dep. NTIS $4.50.

Current literature describing neutron and gamma dosimetry techniques for irradiation testing are reviewed. Tabulations of neutron activation detector characteristics and gamma dosimeters are given. The tabulations are intended to be usable for planning irradiation testing by listing the range, form, availability and limitations of the dosimeters. A recommended form, including units and terminology for reporting dosimetry measurements, is presented. A suggested dosimetric system is given. For additional information on any specific dosimeter, an extensive bibliography is included. (44 references) (auth)

16623 DOSIMETER FOR THE MEASUREMENT OF HIGH DOSES OF PARTICLES OR IONIZING RADIATIONS OF HIGH ENERGY. Philipot, G. A.; Kempen, S. J. (to Societe Kodak-Pathe). French Patent 2,171,865/A/. 11 Feb 1972. 12p. (In French).

The dosemeter, according to the invention, comprises a layer or coating of a sensitive composition containing an azide which, when subjected to ionizing particles and radiations, gives rise to colored products, the optical density of which varies according to the amount of absorbed ionizing particles and radiations. Application of the process to the determination of doses (ranging from 1 to 30 Mrads) of ionizing particles and radiations having a high energy, e.g., from 1 to 10 MeV, is described. (FR)

16624 NEUTRON DOSIMETRY FOR BIOLOGICAL MATERIAL IRRADIATION. Czock, K. H.; Haselberger, N. (International Atomic Energy Agency, Vienna). Rayonnements Ionis. Tech. Mes. Prot.; No. 3, 127-132(Jul 1974). (In French and English).

In a mixed field of neutron and gamma radiation, as is the case in a reactor, it is necessary to separate the contribution of each type of radiation to the total dose. The use of ionization chambers offers a reliable method of measuring the dose from fast neutrons and gamma radiations. Two chambers are used, one of which is sensitive both to fast neutrons and gamma radiation, the other being sensitive to gamma radiation only. The neutron dose rate is obtained by subtraction. To obtain the neutron dose rate in the biological material from the fast neutron dose rate the atomic composition of the former has to be taken into account. For dose rate measurements, the two ionization chambers are put together into the irradiation container of the SNIF, standard neutron irradiation facility, developed by the Austrian Atomic Energy Research Laboratory at Seibersdorf. (FR)

16625 TESTING OF THE CHLOROBENZENE DOSIMETER FOR THE DETERMINATION OF γ-DOSE RATES AT THE ROSSENDORF RESEARCH REACTOR. Fischer, I. (VEB MLW Keradenta-Werk, Radeberg, Ger.). Isotopenpraxis; 10: No. 7, 269-272(Jul 1974). (In German).

A new chemical dosimeter with a chlorobenzene base was tested for the determination of high γ dose rates. The operation of the dosimeter is described. Studies on the calibration of the dosimeter in a ^{60}Co irradiation installation showed, within a deviation of ±4%, good agreement with other chemical dosimeters. On the basis of the study on the time and position dependence of the γ dose rate in irradiation channels of the shut-down Rossendorf research reactor, the efficiency of this type of dosimeter was shown. (tr-auth)

16626 INFLUENCE OF ALCOHOLS AND OTHER ORGANIC SUBSTRATES ON THE RADIATION YIELD OF FRICKE DOSIMETER. I. Das, R. C. (Ravenshaw Coll., Cuttack, India); Bunn, D. Proc. Indian Nat. Sci. Acad., Part B; 39: No. 4, 499-505 (Aug 1973).

From symposium on photochemical and photophysical processes in biological systems; New Delhi, India (27 Jan 1972).

The role of methanol and t-butanol in the increase of the ferric yield in the Fricke radiation dosimeter has been studied and the mechanism given. (auth)

16627 AGGREGATE OF HIGH-PRECISION MEASURING INSTRUMENTS FOR DETERMINING THE ABSORBED DOSE OF RAPID NEUTRONS. Bregadze, Yu. I.; Maslyaev, P. F. Meas. Tech. (USSR) (Engl. Transl.); 17: No. 7, 996-1000(Jul 1974).

Translated from Izmer. Tekh.; 17: No. 7, 14-17(Jul 1974).

In order to transmit the dimensions of the unit absorbed dose of neutron radiations in the energy range of 50 fJ to 2 pJ (0.3 to 14 MeV) from the primary state standard to the working means of measurement, an aggregate of high-precision equipment was produced for measuring the absorbed dose of rapid neutrons. This equipment consists of an installation intended for certification as a working standard and two installations which are intended for use as reference standards after their metrological certification. The working standard consists of the following units: a set of ten ionizing chambers; two current meters for the ranges of 10^{-8} to $5 \cdot 10^{-14}$ A and 10^{-13} to 10^{-15} A; a system for filling the chambers with gas; and a high tension supply source for the chambers. (WHK)

16628 ENVIRONMENTAL FACTOR EFFECTS ON DETECTOR DOSIMETRIC CHARACTERISTICS. Chapter 6. Krongauz, A. N.; Podgornyj, V. N. pp 116-135 of Semiconductor Detectors in Ionizing Radiation Dosimetry. Lyapidevskij, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

The effect of radiation, temperature, and magnetic fields on the dosimetric characteristics, primarily the sensitivity of the semiconductor detectors used for dosimetry of x and γ radiation, is studied. The permissible changes in the sensitivity of dosimeters used in x-ray diagnostics and radiation therapy are reported. It is concluded that the detectors can be useful for universal dosimetry if their sensitivities are changed no more than 5% per year at doses of 0.2 Mrad. The change in the properties of semiconductor detectors with time is examined. (INIS)

16629 DETECTOR DOSIMETRIC CHARACTERISTICS. Chapter 1. Lyapidevskij, V. K. pp 5-28 of Semiconductor Detectors in Ionizing Radiation Dosimetry. Lyapidevskij, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

The general characteristics of detectors used for the dosimetry of x and γ radiation, charged particle radiation, etc are examined. The determination of the basic values characterizing radiation and its interaction with matter (current density, radiation intensity, absorbed dose) is given. A method for the determination of the absorbed dose with detectors having a hardness behavior is described. The basic dosimetric characteristics of detectors during operation in current and pulse regime are examined. These include the sensitivity, efficiency, x-ray amp characteristics, and time characteristics. Methods are described for the variation of the dose sensitivity of detectors to the quantum energy by variation of the thickness and materials of the walls and by combination of several materials in the working volume of the detector. (INIS)

16630 DOSIMETRY WITH SEMICONDUCTOR AND COMBINED DETECTORS. Chapter 7. Lyapidevskij, V. K. pp 136-154 of Semiconductor Detectors in Ionizing Radiation Dosimetry. Lyapidevskij, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

The following methods for the dosimetry of x and γ radiation with semiconductor and combined detectors are described: determination of the exposure and absorbed dose by the method of the simultaneous measurement of two values, determination of the absorbed dose by counting the recorded particles and the average energy of the affecting spectra, and determination of the absorbed dose by complete absorption detectors. The use of semiconductor and combined detectors for phantom measurements is examined. (INIS)

16631 SOME THOUGHTS ON THE SUBJECT OF RADIATION PROTECTION AND SILVER. Felix, R.; Demuth, G. (Bonn Univ. (F.R. Germany). Radiologische Klinik). Roentgen Bl.; 27: No. 9, 472-474(Sep 1974). (In German).

1 ref.

The importance of recovering silver from x-ray film in order to preserve this valuable raw material for the community and for radio-diagnostics is pointed out. Between the beginning of 1974 and the end of March 1974, silver prices increased by some 61%. To date there is nothing which can replace the silver film used in radiology. Due to its unsurpassed sensitivity, it is a decisive factor in that area which has been rightfully so emphasized lately, namely, radiation protection. (auth)

16632 DOSIMETRIC INSTRUMENTS AND DEVICES WITH SEMICONDUCTOR DETECTORS. Chapter 8. Krongaus, A. N.; Mandel'tsvajg, Yu. B.; Podgornyj, V. N. pp 155-167 of Semiconductor Detectors in Ionizing Radiation Dosimetry. Lyapidevskij, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

The peculiarities and characteristics of dosimetric devices with detectors of monocrystalline and polycrystalline CdS and of Si detectors with p-i-n transistors are described. The characteristics of radiometric devices and installations for medical purposes with miniature p-i-n detectors, and with avalanche detectors, radiation instruments for measurement of high voltages, and for industrial control (control of the thickness of the walls of high pressure vessels, and levels of liquids and friable materials) are briefly examined. (INIS)

Nuclear Spectroscopic Instrumentation

16633 (INIS-mf-1274) MOUNTING, FOCUSING, AND CALIBRATION OF THE SPECTROGRAPH IV AND ITS USE IN THE SPECTROSCOPIC EXPLORATION OF ^{41}Ca AND ^{49}Ca BY (d,p) REACTIONS. Olmos, D. D. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1973. 49p. (In Spanish). INIS.

Thesis.

The mounting, focusing, and calibration (using nuclear reactions and ^{210}Po α particles) of a Mattauch–Elbek type double-focusing spectrograph are described. The spectrograph has a magnetic sector of 100°, an angle of inclination of 35° of the inlet slit, and maximum curvature radius of 80 cm and minimum radius of 32 cm. The reactions ^{40}Ca(d,p)^{41}Ca and ^{48}Ca(d,p)^{49}Ca were studied at bombardment energies of 7, 8, and 10 MeV at an observation angle of 90°40′ with a solid subtended angle of 8.43×10^{-4} sr. Photographic emulsions were used as detectors. Attempts to solve the problems encountered in the calculations because of the stray fields are described. (tr-auth)

16634 (INIS-mf-1282) DETERMINATION OF THE FAST NEUTRONS SPECTRA BY ELASTIC DISPERSION (n,p) METHOD. Elizalde D, J. (Instituto Poletecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1973. 77p. (In Spanish). INIS.

Thesis.

The spectra of fast neutrons emitted by a Pu–Be isotopic source were determined. The technique used was based on (n,p) spectrometry. This consists in letting a beam of polyenergetic neutrons impinge of a film of hydrogenous material and detecting the spectrum of protons emitted at a fixed angle. The polyethylene film and the solid-state detector used are placed in a vacuum chamber. The detector is placed at 30° with respect to the direction of the incident neutron beam. The proton spectrum is stored in a multichannel analyzer. The data processing involves the transformation of the proton spectrum observed into the spectrum of the neutrons incident on the film. The neutron energy is related to that of the protons in accordance with collision kinematic equations. The elastic collision cross section of the neutrons with the hydrogen atoms was obtained from the literature. By the application of these relations to the observed spectrum, the incident neutron spectrum is obtained. (tr-auth)

16635 (ITEF–65) TOROIDAL β-SPECTROMETER WITH A HIGH RESOLUTIONS. Tret'yakov, E. F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 22p. (In Russian). INIS.

A description is given of the construction and test results of an iron-free, toroidal beta-spectrometer having a fourfold deflection of particles. The source and detector are placed on the axis of a toroidal coil whose windings have a rectangular form. A resolution of 0.028% was obtained at a source area of 5 mm^2 and a transmission of 0.3%. (tr-SJR)

16636 (JINR–P13-8365) RELATIVE CONTROL SYSTEM OF THE STABILITY AND CALIBRATION OF A MULTICHANNEL CHERENKOV GAMMA-SPECTROMETER. Malakhov, A. I.; Khachaturyan, M. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The control system for the relative stability and calibration of the 90-channel Cherenkov gamma-spectrometer from one pulse light source is described. As a light source, a spark discharge has been used. The method makes it possible to control the relative stability of gamma-spectrometers with a precision of ~1% and to make their absolute calibration. (auth)

16637 TOROIDAL IRON-FREE BETA SPECTROMETER FOR ACTIVATION ANALYSIS. Sokol'skii, V. V.; Solodukhin, V. P.; Smetannikov, V. V. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 4, 45-48(1974). (In Russian).

A description is given of a magnetic toroidal β spectrometer for activation analysis measurements. The device consists of two toroidal windings placed one on top of the other. A dc current generator, stabilized up to 10^{-4}, is the power supply. Stilbene with a photomultiplier is used as a transducer. Automatic control of the spectrometer is provided. The geometric light force of the spectrometer is 20% at 4π and the pulse resolution is 1.9%. Measurements in the energy range from 40 to 500 keV are possible. (tr-auth)

High Energy Physics Instrumentation

Refer also to abstract 17951.

16638 (BARC-768, pp 175-177) CHARACTERISTICS OF MODIFIED MULTI-DETECTOR ROTATING-CRYSTAL SPECTROMETER. Dasannacharya, B. A.; Venkataraman, G.; Thaper, C. L.; Goyal, P. S.; Desphande, A. S. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

16639 (BARC-768, pp 177-181) MULTIPLANE ANALYSER. Chandra, P. P.; Dasannacharya, B. A. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

16640 (ITEF–85) SHORT PROTON PROGRAM. Koroleva, L. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 30p. (In Russian). INIS.

A method of restoring a short track in space, a description of a program for handling an event with a short track, and a program for the BESM-4 computer are presented. (tr-SJR)

16641 (JINR–P13-8283) SYSTEM OF PROPORTIONAL CHAMBERS FOR EXPERIMENTAL SET-UP FOTON. Zanevskii, Yu. V.; Ivanov, A. B.; Ivanchenko, I. M.; Kulikov, Yu. V.; Mikhailova, M. N.; Nikolaevskii, G. P.; Novikov, E. A.; Peshekhonov, V. D.; Plyashkevich, S. N.; Senner, A. E.; Senner, L. A.; Silaev, E. A.; Filatova, N. A.; Khachaturyan, M. N.; Chernenko, S. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A system consisting of six proportional chambers on-line with the computer is used in the FOTON set-up. The results of tests on these chambers in the π^--meson beam of the JINR proton synchrotron are presented. (auth)

16642 DETECTION OF X–RAY TRANSITION RADIATION VIA COMPTON SCATTERING. Mack, J.E. (Department of Geosciences, State University College at Buffalo, Buffalo, New York 14222); Osborne, W.Z.; Pinsky, L.S.; Goodman, C.; O'Brien, J.T.; Gearhart, R.A. Phys. Rev. Lett. 33: No. 26, 1582-1585 (23 Dec 1974).

We report results from an experiment designed to test Compton scattering as a means to avoid charged–particle background in the measurement of x–ray transition radiation. Low–Z scatterers (LiH, Be) were used to ensure Compton–scattering domination of other interactions for initial photon energies between 10 and 150 keV. We demonstrate that the technique can be usefully applied at energies of the Fermi National Accelerator Laboratory. (auth)

16643 CALIBRATION OF THE CEZ-14, INSTALLED ON THE SPACE STATIONS PROTON-1, 2, AND 3, AT THE PROTON SYNCHROTRON OF THE INSTITUTE OF THEROETICAL AND EXPERIMENTAL PHYSICS. Akimov, V. V.; Borisov, V. S.; Veselova, G. V.; Gol'din, L. L.; Kondrat'ev, L. N.; Nesterov, V. E.; Rapoport, I. D.; Ryabova, N. G.; Tumanov, G. K. pp 95-103 of Izuchenie Kosmicheskikh Luchei na Iskusstvennykh Sputnikakh Zemli. Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

The results of the calibration of the CES-14, used on board the Proton space stations for measurement of the inelastic p–C and p-p cross sections at energies of 20 to 600 GeV and for measurement of the energy spectra of primary cosmic radiation, at the proton synchrotron of the Institute of Theoretical and Experimental Physics at proton energies of 5 GeV are reported. During incidence of the protons on the outlet window side, the value of the inelastic p–C cross section measured at 5 GeV was 204 ± 6 mb, which was 8 ± 6% lower than the value measured at an energy of 21.5 GeV on the accelerator. During incidence of the protons on the instrument on the opposite side the measured cross section is equal to 167 ± 10 mb, which is a decrease of 18%. The counting rate was decreased by a factor of 4. On the basis of the data obtained it was concluded that during measurement of the inelastic p-C cross section on the satellite at an energy of 5 GeV of the incident particle the measured cross section was 4% lower in comparison with the values measured with particle incidence on the inlet window side. (tr-auth)

Radiometric Instruments

Refer also to abstract 16546.

16644 (PB-231350) PAVEMENT DESIGN AND PERFORMANCE STUDY. Phase B. Deflection Study: Nuclear Measurement of Subgrade Moisture. Interim Report No. 5. Vaswani, N. K. (Virginia Highway Research Council, Charlottesville (USA)). Nov 1973. 31p. (VHRC-73-R17). NTIS $4.75.

The basic consideration in evaluating subgrade moisture conditions under pavements is the selection of a method of determining moisture contents that is sufficiently accurate and can be used with minimal effort, interference with traffic, and calibrations. In this study, the electrical resistance method and a nuclear method were tried; the nuclear method was adopted. The devices and procedures used in both methods are described. Modified methods for eliminating errors in the measurement of moisture by nuclear depth probes were tried and some of these are recommended for use. A method of reducing the standard error of estimate in the use of a nuclear calibration curve for moisture content by using the sieve analysis of a soil is discussed. (GRA)

16645 (PB-231388) REFINEMENT OF MOISTURE CALIBRATION CURVES FOR NUCLEAR GAGE. Final Report. Wyant, D. C.; Anday, M. C.; Hughes, C. S. III. (Virginia Highway Research Council, Charlottesville (USA)). Dec 1973. 27p. (VHRC 73-R24). NTIS $4.50.

The Troxler Model 227 gage had a linear response between the count ratio and the moisture content. Two moisture calibration curves were required to obtain reasonable accuracy (1.4 pcf or 0.02 g/cc and 1.7 pcf or 0.03 g/cc standard errors). The two curves were test divided by the optimum moisture content of the soil. The separation value of the optimum moisture contents was around 21%. With the more modern Troxler Model 2401 gage only one moisture calibration curve was needed and it had a standard error of 1.7 pcf or 0.03 g/cc. To produce a moisture calibration curve for another nuclear gage four moisture standards were developed using $MgSO_4 \cdot 7H_2O$ or $NaPO_4 \cdot 12H_2O$ mixed with sand. These chemical moisture standards ranged in moisture contents from 9.3 pcf (0.15 g/cc) to 25.8 pcf (0.41 g/cc). Besides these four standards a zero moisture content standard was developed from dry sand. The moisture calibration curve for the model 2401 gage from the five standards indicated a standard error of 0.57 pcf or 0.01 g/cc. (auth)

16646 (PB-232608) PAVEMENT DESIGN AND PERFORMANCE STUDY. Phase B. Deflection Study: Subgrade Moisture and Temperature Variations Under Road Pavements in Virginia. Interim Report No. 6. Vaswani, N. K. (Virginia Highway Research Council, Charlottesville (USA)). Jan 1974. 25p. (VHRC-73-R29). NTIS $4.25.

In the investigation, the changes in the subgrade moisture content under five road pavements ranging in age from new to about ten years old were determined and evaluated. The moisture content was determined by means of a nuclear moisture depth probe. The investigation showed that: (1) the higher compaction and dry density of the subgrade soil, the lower is the moisture content; (2) the subgrade moisture content continues to increase sharply from the beginning to the end of construction and then the rate of increase slows; (3) there is a sharp increase in moisture content due to precipitation within a year or two from the date of the construction of the subgrade (after this period the rate of increase in moisture decreases); and (4) after about ten years there is very little increase in subgrade moisture content. (GRA)

16647 (TPR-74) NUCLEAR METER FOR MONITORING THE SULFUR CONTENT OF COAL STREAMS. Stewart, R. F.; Hall, A. W.; Martin, J. W.; Farrior, W. L.; Poston, A. M. (Bureau of Mines, Morgantown, W. Va. (USA). Morgantown Energy Research Center). Jan 1974. 13p.

A nuclear meter based on measurement of prompt capture gamma rays is being developed for monitoring the sulfur content of coal streams. Equipment has been built to measure sulfur rapidly, and methods have been devised to compensate for changes in moisture, ash, and bulk density of coal flowing through a bin. Pilot plant tests of the system with various additives to different coals show a precision and accuracy of 0.02 percent sulfur and 0.04 percent sulfur, respectively. Based on these results, a hardwired meter has been fabricated for testing in a commercial coal preparation plant. (auth)

16648 (WANL-TME-914) STRAIN GAGES EXPERIMENT NO. 23/W406, IRRADIATED AT PLUM BROOK REACTOR FACILITY, PBRF CYCLE 20P. Preliminary Data Report. Freas, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Aug 1964. 70p. Dep. NTIS $6.50.

Preliminary results of irradiation experiment 23/W406 are presented. In this experiment, sixteen Microdot (weldable) strain gages, adapted to a test fixture, were dynamically tested during irradiation in the HT-1 facility of the Plum Brook Reactor on July 2-4, 1964. The purpose of this experiment was to obtain operational data on NRX-A candidate strain gages in a high dose rate radiation environment. (auth)

16649 MEASUREMENT OF THE ZINC THICKNESS ON CONTINUOUSLY GALVANIZED STEEL SHEET. Gruber, U. Chimia (Aarau); 17: No. 6, 344-345(Jun 1973).

An x-ray fluorescence method is described for continuously measuring the thickness of the zinc coating formed on galvanized steel sheet. The sheet is irradiated with a ^{241}Am source and the Kα x-ray line of zinc measured and compared with the intensity of the Kα line from zinc layers of known thickness. There is a diagram of the installation, and features of the apparatus are illustrated. The method can be used in regulating the thickness of zinc on steel in the range 10 to 40 μm. (Corros. Abstr.)

16650 RADIATION-ACTUATED LEVEL INDICATOR. Leroy, J.; Volat, J. P. (to Societe pour l'Utilisation Rationnelle des Gaz). French Patent 2,183,561/A/. 10 May 1972. 10p. (In French).

An installation for measuring the level in a liquid-filled container is described. This installation comprises a measuring station adapted to receive the container, an electromagnetic radiation source adapted to emit a beam directed into said container, an electromagnetic detector, or sensor, so located as to receive said beam after emergence thereof from said container, and an electronic system adapted to treat the information signal provided by said detector so as to generate an output signal which varies according to the level of the liquid contained in said container. Said source is so directed as to emit a vertical beam, so that the information signal fed by the detector varies continuously according to the weight of the liquid contained in said container and is independent of the temperature of said liquid. (FR)

16651 RADIOACTIVE RADIATION DETECTION SYSTEM. Pozdnikov, V. N.; Sazonov, O. L.; Taxar, I. M.; Tesnavs, E. R.; Yanushkovskii, V. A.; Gavrilov, A. P.; Korkonosov, V. P.; Peresypkin, A. V.; Shapovalov, E. P. US Patent 3,848,131. 12 Nov 1974. Filed date 16 Aug 1972. 10p.

A radioactive isotope relay device in which ionizing radiation is registered by a detector unit converting it into electric pulses fed to an electronic-relay unit is described. The latter comprises a discrete comparison device, a relay element and a setter of threshold frequencies of a regular series of electric pulses, the setter being characterized by two frequency thresholds. One input of the discrete comparison device is connected to the detector unit which delivers a statistic series of electric pulses. The outputs of the comparison device are connected to the relay element. The inputs of the threshold frequency setter are connected to the outputs of the relay element while the output of the former is connected to the second input of the discrete comparison device due to which arrangement the device will acquire either the "yes"- or the "no"-state depending upon the ratio between the compared frequencies of the statistic and regular pulse series. (Official Gazette)

16652 LIQUID FLOW METER USING RADIOISOTOPES. de Lima, W.; Hamburger, E. W. (Sao Paulo Univ. (Brazil). Instituto de Fisica). Rev. Brasil. Tecnol.; 4: No. 1, 85-93(Mar 1973). (In Portuguese).

A flow meter for liquids using injection of radioisotopes and the pulse velocity method has been developed. The meter includes an isotope injector, power supply and integrator. The system was tested on water tubes $1\frac{1}{4}$″ and 6″ in diameter. Performance was satisfactory, and precision was 1 to 3% even in unfavorable cases. The cost is low compared to other flow meters, installation is easy, and the radioactive contamination negligible. (INIS)

16653 PROBLEM OF MEASURING THE MOISTURE OF GLASS-REINFORCED PLASTICS BY MEANS OF FAST NEUTRONS (EXCHANGE OF EXPERIENCE). Pekarskii, G. Sh.; Elagin, V. B. (Scientific-Research Inst. for Electronic Introscopy, Tomsk, USSR). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 7, 1003(Jul 1974).

Translated from Zavod. Lab.; 824(Jul 1974).

The principle of operation and performance of a neutron radiometric gage for measuring the moisture of glass-reinforced plastics are described. (WHK)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstract 17660.

16654 (AGC-7461-0094) TUNGSTEN-RHENIUM THERMOCOUPLE PERFORMANCE IN GTR-13 TEST. Fluke, G. L. (Aerojet-General Corp., Sacramento, Calif. (USA)). 6 Jul 1964. 18p. Dep. NTIS $4.00.

Two tungsten-rhenium thermocouples, a W-W/26% Re model manufactured by Auto-Control Lab and a W/5% Re-W/26% Re Aerojet model manufactured by Aero-Research, were irradiated in GTR Test No. 13. The test was conducted for one-hundred hours. The approximate neutron fluxes were 8×10^{11} and 2×10^{12} n/cm^2-sec for fast and thermal neutrons, respectively. The gamma field was about 10^9 ergs/gm(C)-hr. The W/5% Re-W/26% Re thermocouple malfunctioned (severe rise in millivolt output) 18.8 hours after the beginning of the test. Subsequent readings (the thermocouple completed the test) were erratic in that they fluctuated over a range of millivolt outputs. The W-W/26% Re thermocouple withstood the test although it showed a gradual decline in output throught the test which exceeded the computed neutron effects. (auth)

16655 (RN-S-0037) FINAL TEST REPORT ON RADIATION EFFECTS TEST 25/A002 PERFORMED ON 9 PRESSURE TRANSDUCERS AT GTR. (Aerojet-General Corp., Azusa, Calif. (USA)). Aug 1963. 30p. Dep. NTIS $4.50.

Four Giannini, potentiometer-type, pressure transducers, four Servonics, potentiometer-type pressure transducers and one Statham, unbonded, strain-gage type, pressure transducer were tested in GTR in August 1963 for 68 hours. Temperatures during the test ranged from ambient to 250°F and external pressure was atmospheric. Neutron and gamma dose were measured, the transducers were stimulated with dry nitrogen pressure and responses were recorded at intervals throughout the test. (auth)

16656 (RN-S-0063) PRE-IRRADIATION ANALYSIS OF TEST 23/L101 RESISTANCE TEMPERATURE TRANSDUCERS (GTR-12, March 1964). (Aerojet-General Corp., Azusa, Calif. (USA)). Mar 1964. 77p. Dep. NTIS $7.00.

The results of a pre-irradiation analysis for resistance temperature transducers (test 23/L101) which are scheduled to be irradiated at LH$_2$ temperatures at the ground test reactor facility during March 1964 (GTR Test No. 12) are presented. The following resistance temperature transducers were considered in this analysis: Winsco Model 2448-5, Temtech Model 1117, Rosemount 134 EB, and Rosemount 110 AA. In addition to the test components, the test fixture design is also reviewed and recommendations are made concerning both design and operational procedures. Based on the analysis presented, temperature errors are predicted for all phases of both test 23/L101 and NRX-A2 operation. This analysis indicates that all components should survive the test; however, corrections will be required for units after they have been irradiated or the data will not be repeatable between pre- and post-test to within 0.2°F. (auth)

16657 (RN-S-0087) RADIATION EFFECTS ANALYSIS FOR WIANCKO MODEL AX-44 ACCELEROMETER. (Aerojet-General Corp., Azusa, Calif. (USA)). Apr 1964. 17p. Dep. NTIS $4.00.

This report summarizes the results of a radiation effects analysis performed on the Wiancko Model AX-44 accelerometer, which is presently being considered for possible application in NRX-A2. This analysis considers various mounting arrangements, gamma heating rates, gases for damping, and air flow conditions. The results of this study indicate that the Wiancko AX-44 accelerometer is radiation resistant but its application may be limited primarily by installation design. It is recommended that this design be tested in a radiation environment as soon as possible. (auth)

16658 (RN-S-0157) FINAL TEST REPORT RTT TEST 23/L101. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1964. 51p. Dep. NTIS $5.75.

Eleven platinum wire resistance temperature transducers were irradiated for fifty hours in liquid hydrogen at the Ground Test Reactor (GD/FW) during April 1964 (Test 23/L101-GTR-12A). Five Rosemount Model 134EB, two Rosemount Model 110AA, and four Winsco Model 2448-5 RTT's were subjected to integrated fast neutron fluxes as high as 9.9×10^{15} nvt ($E > 2.9$ MeV) while being maintained at −423°F. The results of this test followed closely the predicted performance with respect to temperature measurement errors (2.0 to 6.0°F); however, three transducer circuits (two Winsco Model 2448-5 and one Rosemount Model 110AA) experienced open circuits during irradiation. (auth)

16659 (RN-S-0180) EVALUATION OF TEST RESULTS FOR PRESSURE TRANSDUCERS AND ACCELEROMETERS. Ground Test Reactor (GTR) Irradiation Test No. 10. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1964. 64p. Dep. NTIS $6.25.

This document presents an analysis of the test results for pressure transducers and accelerometers that were tested in GTR-10 during the month of October 1963. This report is submitted in partial fulfillment of subtask 2.4, Contract SNP-1. (auth)

16660 (RN-S-199) RADIATION EFFECTS ANALYSIS OF NERVA CANDIDATE ACCELEROMETERS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1965. 94p. Dep. NTIS $7.75.

A radiation effects analysis was performed on the following NERVA candidate accelerometers: Wiancko AX-44, Statham A519, and the Clevite 25D21X which are scheduled for testing at NRDS concurrently with the NRX-A3 reactor test (Test 23/R005). In addition to the materials, design, and prior radiation testing experience reviews for each unit, a detailed parametric thermal analysis was performed in which the following boundary conditions were investigated: gamma heating rate, heat sink temperatures, air temperature, and air flow rate. A thermal analysis is also included for the Endevco Model 2242 accelerometer. The performances of each unit are compared and conclusions regarding the application and limitation of each unit are discussed. (auth)

16661 (RN-S-0257) FINAL TEST SPECIFICATION FOR PRESSURE TRANSDUCER EXPERIMENT 23/R510. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1965. 47p. Dep. NTIS $5.50.

The test described is a development irradiation test of a pressure transducer design which is a candidate for use in the NRX nozzle chamber control loop. The primary purpose of this test is to study the effects of thermal gradients resulting from gamma heating rates comparable to those of NRX. Rate effects and cumulative damage, resulting from gamma and neutron radiations are also of interest. The transducer stimulus will be varied in 80-psi increments from zero psig to 400 psig and back to zero at each reactor power level. Transducer output, coil resistance, insulation resistance, and transducer housing temperature will be measured and recorded at each power level. When sufficient data have been gathered to satisfy the primary purpose of the test, the test items will be irradiated and data recorded until failure occurs. Failure is defined as greater than 25% degradation of output. (auth)

16662 (RN-S-0291) EVALUATION OF TEST RESULTS FOR STRAIN GAGES AND PRESSURE TRANSDUCERS. Ground Test Reactor (GTR) Irradiation Test No. 15. Sita, E. R. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1966. 68p. Dep. NTIS $6.50.

This document presents an analysis of the test results for weldable, full-bridge strain gages and vapor-deposited, strain gage pressure transducers that were irradiated at the Nuclear Aerospace Research Facility (NARF) of General-Dynamic/Fort Worth, Texas, during the month of December 1964. This report is submitted in partial fulfillment of Subtask 2.4, Contract SNP-1. (auth)

16663 (WANL-TME-520) PRELIMINARY DATA REPORT, NRX-A CANDIDATE DIAGNOSTIC TRANSDUCERS IRRADIATED AT PLUM BROOK REACTOR FACILITY, PBRF CYCLE 4 - (PB No. IW). Stephens, A. G.; Grimm, D. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1964. 31p. Dep. NTIS $4.75.

Preliminary results of the irradiation test on strain gages, resistance thermometers, and copper-constantan thermocouples, conducted at the Plum Brook Reactor Facility in Sandusky, Ohio, on September 5 to September 8, 1963, are described. The purpose of the experiment was to obtain operational data on the NRX-A candidate transducers in a high dose rate radiation environment. (auth)

16664 (WANL-TME-753) FINAL TEST SPECIFICATION FOR NRX-A CANDIDATE STRAIN GAGES TO BE IRRADIATED AT THE PLUM BROOK REACTOR (23/W406). Pappas, T. A.; Solberg, D. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1964. 18p. Dep. NTIS $4.00.

Gages to be utilized in the test are as follows: 6 Microdot SG-123/5, Sr-32; 6 Microdot SG-333/1, Sr-31; and 4 Microdot SG-323/1, Sr-30. Eight test beams, of 304 stainless steel, with a strain gage mounted on each side of the beam will be used. Each of the strain gages will be provided with a 13-foot long stainless steel sheathed, 3-conductor, MgO insulated cable. The 13-foot length is sufficient to reach through the Conax fittings located on the back plate of the capsule. The end of the sheathed cable will be spliced to a shielded, 3-conductor extension cable insulated with irradiated polyolefin. The splice joint will be covered with a piece of shrinkable, irradiated polyolefin tubing. All of the extension cables will be enclosed within Tygon tubing to protect them from the quadrant water. (WHK)

16665 (WANL-TME-916) PRESSURE TRANSDUCERS EXPERIMENT No. 23/W506, IRRADIATED AT PLUM BROOK REACTOR FACILITY, PBRF CYCLE 22P (PB No. 8W). Preliminary Data Report. Freas, D. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Sep 1964. 38p. Dep. NTIS $5.00.

Preliminary results of experiment 23/W506, irradiated during PBR Cycle 22P, are presented. In this experiment, two Wianko variable reluctance absolute pressure transducers, Model No. 54726, and two Wianko variable reluctance differential pressure transducers, Model No. 54727 were dynamically tested during irradiation in the PBR HT-1 facility on July 29 and 30, 1964. Experiment 23/W506 was designed to evaluate the performance of the Wianko pressure transducers under dose rate conditions approaching and exceeding those to be experienced in both NRX-A2 and NRX-A3 applications. Since these transducers in application are to be utilized in fields of different radiation levels, this irradiation experiment was exposed to various radiation dose rates. In an effort to obtain comparable data, the pressure transducers of this experiment were pressure cycled before, during, and after irradiation. (auth)

16666 (WANL-TME-1278) NRX-A CANDIDATE ACCELEROMETERS EXPERIMENT NO. 23/W006 IRRADIATED AT PLUM BROOK REACTOR FACILITY PBRF CYCLE 38P. Preliminary Data Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 66p. Dep. NTIS $6.50.

This report describes the preliminary results of the irradiation of four accelerometers that were dynamically tested and two capsules that were statically tested in the HT-1 facility of the Plum Brook Reactor from August 30 to September 1, 1965. The purpose of this test, designated Experiment No. 23/W006, was to obtain operational data on NRX-A candidate accelerometers in a high dose rate radiation environment. In addition, a wire and cable sealant test related to the use of the accelerometers was also irradiated. Information on the design and hazards analyses for the loop are included in WANL-TNR-173. Final test specifications for this experiment are described in WANL-TME-1088. (auth)

16667 (WANL-TME-1348) PRESSURE TRANSDUCER IRRADIATION TEST AT THE PLUM BROOK REACTOR FACILITY 23/W508. Blinn, H. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1965. 45p. Dep. NTIS $5.25.

Data obtained during an irradiation test of six pressure transducers at the Plum Brook Reactor Facility at Sandusky, Ohio are presented. The purpose of the test was to evaluate the performance of strain gage type pressure transducers in a radiation environment. Also two Wiancko variable reluctance pressure transducers were included for determining gamma heating effects. (auth)

16668 (WANL-TME-1362) IRRADIATION TEST OF NERVA CANDIDATE PRESSURE TRANSDUCERS AT THE PLUM BROOK REACTOR FACILITY (EXPERIMENT 23/W508) (NE 2450 and NE 2460). Weldon, T. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 Jan 1966. 62p. Dep. NTIS $6.25.

The findings and analysis of a Plum Brook (Experiment 23/W508) irradiation test of pressure transducers to determine their performance capabilities in NERVA applications are presented. Three different manufacturers' transducer types were included in the test. The effect of irradiation rate on transducer accuracy is presented in a manner to assist in predicting the performance of the transducers tested under any NERVA applications within transducer ratings. A review of the probable causes of error under high gamma irradiation rates (neutron heating is minimized by material selection in transducer design) is presented as a means of further improving transducer and/or system performance. (auth)

16669 (WANL-TME-1993) HIGH CURRENT PULSE ATTENUATION OF BELL AEROSYSTEMS PYROHARNESSES NO. 302 AND NO. 308. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1969. 36p. Dep. NTIS $5.00.

Results are presented of tests on the shielding capabilities of Bell Pyroharnesses No. 302 and 308 while subjected to current pulses in the 10^3 amp range to simulate induced currents caused by incident high-intensity electromagnetic pulses. The EMP attenuation tests illustrated that both should perform satisfactorily from a shielding viewpoint in the intended application. When feeding various legs of the harness and driving a 50Ω load, the attenuations observed fell between 80 and 100 db, and while driving a $\frac{1}{4}\Omega$ load the attenuation fell as low as 54 db in the J31 input configuration on harness 308, but the remainder of the tests averaged in the mid-70 db range. (WHK)

16670 VORONEZH SBORNIK TRUDOV PO POLUPROVODNIKOVYM MATERIALAM, PRIBORAM, I IKH PRIMENENIYU. (Collection of Works on Semiconductor Materials, Instruments, and Their Use). Voronezh, USSR; Politekhn IN-T (1971). 216p.

Problems are studied which are related to the measurement and analysis of the parameters of semiconductor instruments and integrated circuits and also with the effect of temperature, irradiation, dislocation, and the surface state on these parameters. Problems are touched upon dealing with the production of semiconductors and dielectric films and the measurement of their physical properties. (Referativnyi Zh)

16671 ELECTRON IRRADIATION EFFECTS IN MOS SYSTEMS. Churchill, J. N. (Univ. of California, Davis); Collins, T. W.; Holmstrom, F. E. IEEE Trans. Electron Devices; ED-21: No. 12, 768-777(Dec 1974).

Flat-band shift measurements were made on p-type MOS devices irradiated with electrons at various gate-bias voltages. A structured reproducible curve of flat-band shift versus gate bias was obtained which could not be readily accounted for with existing models. Experimental data were taken over a wide range of negative and positive gate-bias voltages (consistent with electrical breakdown limits) in order to identify fundamental mechanisms as a basis for formulating a more general model of the entire device. A model is presented based on the known work functions and electron affinities for $Al-SiO_2-Si$ devices. It assumes that traps in the oxide are occupied according to Fermi-Dirac statistics, subject to constraints determined by the interface parameters. A linearized quasi-Fermi level is assumed in the oxide, and the resulting distribution of charged traps is used with Poisson's equation to obtain a self-consistent energy-band structure throughout the entire device. (auth)

Miscellaneous Instruments

Refer also to abstracts 16198 and 19083.

16672 (BARC-768, pp 86-90) CHOICE OF SCANS IN NEUTRON DIFFRACTION. Sequeira, A. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

16673 (BARC-768, pp 93-96) EFFECT OF CRYSTAL AND COLLIMATOR MISALIGNMENTS ON BRAGG ANGLE MEASUREMENTS. Wadhawan, V. K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

16674 (BARC-768, pp 171-172) DISTORTED SINGLE CRYSTALS OF GERMANIUM AS NEUTRON MONOCHROMATORS. Deshpande, A. S.; Thaper, C. L.; Dasannacharya, B. A.; Iyengar, P. K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

16675 (CEA-N-1692) NUCLEAR ELECTRONIC EQUIPMENT FOR CONTROL AND MONITORING BOARDS. Specifications and Test Methods of Campbell Technique Instrumentation. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Services d'Electronique). Feb 1974. 52p. (In French). Dep. NTIS (US Sales Only) $5.75.

Neutron instrumentation using the statistical properties of fluctuations, i.e., Campbell technique, is studied. A terminology is proposed and a whole chapter is devoted to theoretical reminders regarding the properties of circuits subjected to random excitations. Therein defined are typical instruments under fluctuation operation only or those linked to measuring channels that are current or impulse operated. Reviewed are the main characteristics, errors, measuring range, drift... regarding preamplifier, linear amplifier, logarithmic amplifier functions included in such instrumentation and specific definitions are proposed. The last chapter deals fully with an outline of the methods leading to the measurement of such characteristics. (auth)

16676 (HEDL-SA-726) HIGH TEMPERATURE ULTRASONIC TRANSDUCERS FOR IN-SODIUM SERVICE. Smith, R. W.; Day, C. K.; Kelly, W. L. (Westinghouse Hanford Co., Richland, Wash. (USA)). 1974. 4p. (CONF-741123-2). Dep. NTIS $4.00.

From ultrasonics symposium; Milwaukee, Wisconsin, USA (11 Nov 1974).

Ultrasonic transducers developed for use in the optically opaque, high radiation environment of LMFBRs can be applied to measure, inspect, and visualize the internal LMFBR components. The transducer described was developed for imaging and ranging applications in liquid sodium during reactor shutdown. To assure rapid, complete wetting (and thus good acoustic coupling) of the stainless steel transducer face by liquid sodium, the face is thermally etched at 1000°C in a vacuum. A layer of gold is deposited on the surface to passivate the face until the transducer is inserted into liquid sodium, whereupon the gold rapidly dissolves, leaving a clean surface exposed to the sodium. The operating temperature limit is about 560°F, the nominal melting temperature of the bonding alloy used to fasten the piezoelectric active element into the stainless steel case. A number of transducers have been successfully operated for several hundred hours in 500°F liquid sodium. The transducer, fabrication process, and some of the reactor applications are discussed. (auth)

16677 (HEDL-TME-74-60) COMPUTER CONTROLLED DATA ACQUISITION SYSTEM FOR THE HIGH TEMPERATURE SODIUM TEST FACILITY. Dozer, B. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-2170. 32p. Dep. NTIS $4.00.

The HTSF Data System is a computer-controlled data acquisition system used to gather data acquired during scientific experiments. These experiments vary in nature but, in general, are concerned with the U. S. Atomic Energy Commission's Liquid Metal Fast Breeder Reactor Program. Most experiments involve testing components and equipment for use in nuclear reactor service in a liquid sodium environment. To a large extent, the data come from thermocouples and standard process transmitters measuring flow, pressure, and temperature. Some special instruments such as electro-magnetic flow meters and gas chromatographs are also involved. Design and operation of the system are described. (WHK)

16678 (INIS-mf-1283) DESIGN, CONSTRUCTION, AND OPERATION OF A MASS SPECTROMETER FOR ISOTOPIC RATIOS OF URANIUM. Casar A, M. I. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ciencias). 1973. 91p. (In Spanish). INIS.

Thesis.

Mass spectrometry is considered as one of the best techniques for the isotopic analysis of U since the entire range of enrichment of U can be realized with a precision of 1% in the measurement of the $^{235}U/^{238}U$ ratio and it is capable of measuring the abundances of the minor isotopes such as ^{234}U and ^{236}U. In order to realize this analysis, a mass spectrometer was constructed with the following characteristics: a triple filament surface ionization source capable of analyzing samples from 10^{-4} to 10^{-7} g with energy dispersion of $^1/_{20,000}$. It has an analyzer system which is an electromagnetic sector of 60° and radius of 25 cm variable from 0 to 10,000 G and $\Delta B/B$ control of $^1/_{40,000}$. The analyzing system has directional first order focusing and a resolving capacity of 300. The detection system consists of a Faraday cup for the collection of ions and a system capable of measuring those ions producing currents of the order of 10^{-15} amp. The mass spectrometer also has a vacuum system capable of reducing the pressure to 10^{-8} torr in four hours and an automatic data acquisition system. The same U sample was analyzed with this spectrometer 10 times and the value $^{235}U/^{238}U = 0.0056 \pm 0.0006$ was obtained, whereas the actual value of natural U is 0.0072. Plans to improve the accuracy are outlined. (tr-auth)

16679 (INIS-mf-1286) COINCIDENCE TECHNIQUE USE IN NUCLEAR EXPERIMENTS. Morales M, A. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ciencias). 1973. 87p. (In Spanish). INIS.

Thesis

The coincidence method is an important tool in the field of experimental physics, particularly in nuclear physics. The principal electronic coincidence methods are described and an example of their use in a Compton polarimeter is given. In order to obtain the principal parameters of a Compton polarimeter, the cross section for the interaction of polarized γ radiation with matter was determined. (tr-auth)

16680 (RN-S-0088) PRE-IRRADIATION ANALYSIS OF TEST 23/L302 TUNGSTEN/TUNGSTEN-RHENIUM THERMOCOUPLES GROUND TEST REACTOR (GTR) IRRADIATION TEST NO. 13. (Aerojet-General Corp., Azusa, Calif. (USA)). May 1964. 74p. Dep. NTIS $6.75.

The results of a pre-irradiation analysis for two Aerojet designed tungsten/tungsten-rhenium thermocouple probes (Test 23/L302) which are scheduled to be irradiated at the Ground Test Reactor facility during May 1964 (GTR Test 13) are presented. Based on the analysis presented, temperature errors are predicted for both Test 23/L302 and NRX-A2 operation. The analysis indicates that the performance of these thermocouples is not limited by the radiation environment as the decalibration anticipated in GTR-13 and NRX-A2 because of nuclear effects, is less than 2%, which is within design specifications. (auth)

16681 (RN-S-0277) DEVELOPMENT OF A MULTI-COLOR INFRARED RADIOMETER TO MEASURE NERVA NOZZLE WALL TEMPERATURES. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1966. 71p. Dep. NTIS $6.75.

A multi-color infrared radiometer which encodes optical wavelength information from a heated surface as electrical frequency by means of an Aerojet-developed color-coding reticle (CCR) was designed, fabricated and tested and calibrated under simulated nozzle end-use conditions prior to installation on NERVA nozzle S/N 021. Four units were included in the special instrumentation for the first four chemical firings of this nozzle in Test Series 1.2-11-NNN. Failure of the units to give quantitative temperature data is ascribed to relatively low sensitivity of the high-resolution system as impaired by off-design installation modifications and resultant signal strength attenuation. Continued development is recommended based on laboratory demonstration of the concept and a continuing need for measurement of nozzle tube wall temperatures. (auth)

16682 (RN-S-0308) ETS-1 DATA ACQUISITION SYSTEM ACCURACY TEST SPECIFICATION. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1966. 61p. Dep. NTIS $6.25.

This document describes the types of tests and factors to be considered to provide an estimate of the accuracy of the diagnostic portion of the ETS-1 Data Acquisition System. The ETS-I Data Acquisition System collects data from thermocouples, strain gages, resistance temperature bridges, swept potentiometers, resistance temperature transducers, and other transducers. (WHK)

16683 (RN-S-0308A) ETS-1 DATA-ACQUISITION SYSTEM FINAL ACCURACY TEST SPECIFICATION. Cooper, R.; Porter, L. K.; Benenson, H. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1967. 53p. Dep. NTIS $5.75.

This document describes the types of tests and factors to be considered to provide an estimate of the accuracy of the diagnostic portion of the ETS-1 Data Acquisition System. The ETS-I Data Acquisition System collects data from thermocouples, strain gages, resistance temperature bridges, swept potentiometers, resistance temperature transducers, and other transducers. This is a revision to the RN-S-0308 specification. (WHK)

16684 (RN-S-0389) ETS-1 DATA SYSTEM PRELIMINARY ACCURACY TEST, DATA ANALYSIS. Benenson, H.; Cooper, R. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1967. 65p. Dep. NTIS $6.25.

This report contains an analysis of preliminary test data obtained to determine the accuracy of the ETS-1 digital data system for data acquisition from thermocouples, strain gages, resistance temperature transducers, and potentiometers. The tests, which met the requirements of RN-S-0308, ETS-1 Data Acquisition System Accuracy Test Specification, were designed to aid in defining the overall test plan for the comprehensive determination of ETS-1 digital data system uncertainty. Engineering unit tapes of the data were not available during the period the analyses were conducted. Thus, it was necessary to analyze the data "by hand," using digital printouts. To reduce the computation time, a selected number of data channels were completely analyzed and spot checks made of other channels. The data appeared very consistent. It is believed that a firm basis has been established for revisions to the final test plan. (auth)

16685 (RN-S-0484(Vol.1)) INSTRUMENTATION CALIBRATION DATA LOG BOOK XE-2. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1968. 192p. Dep. NTIS $12.75.

This two-volume report presents calibration data for all instrumentation used in the XE-2 test. The data are grouped into nine major categories relative to the type of instrumentation used. These sections are: (1) transducers, pressure, strain gage; (2) transducers, weldable, strain gage; (3) transducers, resistance temperature (RTT); (4) accelerometers; (5) thermocouples, surface; (6) thermocouples, probe; (7) W5%Re/W26%Re thermocouple probes; (8) heat-rate sensors; and (9) gamma-rate detectors (and control units). This report is presented in two volumes. Section I pertains to the UTSA and Section II pertains to the LMA. (auth)

16686 (RN-S-0484(Vol.2)) INSTRUMENTATION CALIBRATION DATA LOG BOOK XE-2. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1968. 519p. Dep. NTIS $29.00.

This two-volume report presents calibration data for all instrumentation used in the XE-2 test. The data are grouped into nine major categories relative to the type of instrumentation used. These sections are: (1) transducers, pressure, strain gage;

(2) transducers, weldable, strain gage; (3) transducers, resistance temperature (RTT); (4) accelerometers; (5) thermocouples, surface; (6) thermocouples, probe; (7) W5%Re/W26%Re thermocouple probes; (8) heat-rate sensors; and (9) gamma-rate detectors (and control units). This report is presented in two volumes. Section I pertains to the UTSA and Section II pertains to the LMA. (auth)

16687 (RN-S-0489) XECF POSTTEST INSTRUMENTATION. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1968. 10p. Dep. NTIS $4.00.

This report discusses the performance of those XECF strain, vibration, temperature, and pressure data channels for which Aerojet-General Corporation (AGC) had the sole transducer provisioning responsibility. Investigation of the causes of data anomalies revealed engine operating realms and data-system characteristics that were not known or were not properly accounted for prior to the test. The observed anomalies were primarily induced by unsatisfactory instrumentation installation and inadequate measurand range predictions. Information obtained from this test is being used to minimize the appearance of similar anomalies during future tests. (auth)

16688 (RN-TM-0362) LEAD WIRE INDUCED MEASUREMENT UNCERTAINTY IN COPPER-CONSTANTAN THERMOCOUPLE CIRCUITS WHEN MEASURING LIQUID HYDROGEN TEMPERATURES. Samuelson, R. D. (Aerojet-General Corp., Sacramento, Calif. (USA)). 2 Aug 1966. 35p. Dep. NTIS $4.75.

The content of this report is limited to a discussion of cable-induced measurement uncertainties within thermocouple data acquisition systems. Measurement uncertainties contributed by the thermocouple transducer, signal conditioners, and recorders are not discussed. Special emphasis has been placed on the measurement uncertainties encountered when employing extension wire in copper-constantan thermocouple channels that are used to measure liquid hydrogen temperatures. (auth)

16689 (RN-TM-0594) THERMOCOUPLE REFERENCE JUNCTION RECOMMENDATIONS FOR NERVA FLIGHT APPLICATIONS. Samuelson, R. D. (Aerojet-General Corp., Sacramento, Calif. (USA)). 3 Dec 1969. 63p. Dep. NTIS $6.25.

Various techniques used to control thermocouple reference junction temperatures and the methods used to compensate for a drifting reference junction temperature are described. The design and application of thermocouple reference junction modules are discussed together with a description of passive zone box utilization. The various thermocouple circuit compensation techniques are compared and the factors contributing to the selection of particular techniques for NERVA applications are presented. (auth)

16690 (UCRL-76234) MICROPROCESSORS IN COMPUTING. Maples, M. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Nov 1974. 13p. (CONF-750206-2). Dep. NTIS $4.00.

From CONPON conference; San Francisco, California, USA (25 Feb 1975).

Two unusual applications of microcomputer applications are described: (1) monitoring a tritium experiment in which mathematical computations are made and (2) calculating spectral data from a pulse-height analyzer. The mathematical program used by both experiments is a triple-precision, floating-point set of routines. These routines were developed by Recognition System as a double precision floating-point package but modified to triple precision at LLL. (auth)

16691 (WANL-TME-420(Suppl.2)) MODIFICATIONS TO FINAL TEST SPECIFICATIONS ON NOS. 23/W004 (ACCELEROMETERS) AND 23/W503 (PRESSURE TRANSDUCERS). Kalapaca, H.; Zorn, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1963. 8p. Dep. NTIS $4.00.

Modifications necessary to the Final Test Specifications on Test Nos. 23/W004 (Accelerometers) and 23/W503 (Pressure Transducers), which were initially issued under WANL-TME-420, "Final Test Specifications for Candidate NRX-A Diagnostic Transducer to be Irradiated at the Ground Test Reactor During July 29–August 2, 1963" are described. The technical aspects of these changes have been discussed with GD/FW and WANL personnel at the GTR site and have been found mutually feasible. (auth)

16692 (WANL-TME-685) C2 SUPPORT SYSTEM TESTS. Computer Program to Reduce and Plot Static Strain Gage Data. McCune, W. C.; Farabaugh, A. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Jan 1964. 67p. Dep. NTIS $6.50.

This program is written in Fortran II for the IBM 7094 digital computer and for the General Dynamics SC 4020 cathode ray plotter. The data reduction involves calculating stress from single, right angle and rosette strain gages. The stress calculations for each gage take into account temperature variations in gage factors, apparent strain and modulus of elasticity. The information that is processed by this program comes directly from the C2 tests for the NRX-A reactor support system in the form of multichannel printed tapes. (WHK)

16693 (WANL-TME-899) ACCEPTANCE TEST SPECIFICATIONS/PROCEDURE FOR THERMOCOUPLES. Burlas, T. C.; Karako, E. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Aug 1964. 8p. Dep. NTIS $4.00.

All thermocouples will be given this acceptance test before they are used for reactor testing. The acceptance test will involve a thermocouple resistance measurement and an insulation resistance measurement. For thermocouples that arrive at WANL, but require further processing before they are used (i.e., gold plating, etc.), the acceptance tests will be performed after the processing work is accomplished. Specifications for the acceptance test are given. (auth)

16694 (WANL-TME-909) EFFECT OF HEAT TREATING AND BRAZING PROCESSES ON INSTRUMENTATION. Hanzlik, H. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Aug 1964. 12p. Dep. NTIS $4.00.

As the result of a series of experiments it was found that short time exposures of sheathed copper-constantan thermocouples to localized temperatures as high as 1525°F does not affect their emf output or function. Similarly, exposure of sheathed chromel-alumel thermocouples to temperatures as high as 2150°F for 30 minutes (in argon) resulted in no detrimental effects with regards to function. (auth)

16695 (WANL-TME-1004) DESIGN AND PERFORMANCE ANALYSIS OF A PRESSURE CONTROL SYSTEM FOR THE TEST CELL A FEEDSYSTEM. Walsh, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Oct 1964. 37p. Dep. NTIS $5.00.

A gas pressure control system has been designed for the test cell "A" feedsystem to improve the reliability and performance of the turbine speed system. This pressure system normally functions to control the gas pressure at the inlet to the turbine throttle valve, PCV 50. However, in the event of a failure in the turbine speed system, the pressure control system automatically takes over to control the turbine speed. An analog simulation for the test cell "A" feedsystem has shown satisfactory performance for the pressure-speed system at all required liquid flow rates and various storage tank pressure levels. (auth)

16696 (WANL-TME-1060) NON-NUCLEAR EVALUATION OF THE WIANCKO DEVELOPMENTAL ACCELEROMETER TYPE AX-44. Loftus, W. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Dec 1964. 28p. Dep. NTIS $4.50.

This report describes a series of tests which were conducted during the non-nuclear evaluation of the Wiancko developmental variable reluctance type accelerometer. The accelerometers were purchased as a system which included Wiancko electronics. As a system, the purchase specification was not met with respect to frequency response and temperature sensitivity. When used with Crescent-East electronics, good high temperature performance was obtained. The accelerometers are to be retained for use with this electronics system. (auth)

16697 (WANL-TME-1199) NON-NUCLEAR QUALIFICATION TESTING OF THE PHYSICAL SCIENCES MODEL AT-302-2 ACCELEROMETER. Loftus, W. D.; Pappas, T. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Jun 1965. 30p. Dep. NTIS $4.50.

This report presents the results of the non-nuclear qualification testing performed on two Physical Sciences Type AT-302-2 variable reluctance accelerometers (WANL Part No. 978D193H02). One unit developed an intermittent short in the coil windings, and hence could not be tested. The other unit exhibited a wide deviation from the performance requirements of the accelerometer Equipment Specification and is not acceptable in its present state. The performance characteristics of this unit are presented. The operable unit is scheduled for irradiation testing at the Plum Brook reactor during July 1965 in order to determine its performance characteristics in a high level nuclear environment. (WHK)

16698 (WANL-TME-1271) OPERATIONAL MANUAL FOR WANL NRX LOG MICROAMMETER. Hardies, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 36p. Dep. NTIS $5.00.

This operational manual contains the general description, theories of operation, alignment procedures, maintenance and repair data, and interconnection diagrams for the WANL NRX Log Microammeters. The WANL-NRX Microammeter is a rack mounted, wholly self-contained, transistorized electronic measuring device. It displays (via a 5 decade meter) a current proportional to the logarithm of the input current in the 10^{-10} to 10^{-5} ampere range. These five decades of power build-up are displayed on a meter scale divided into five equally spaced but logarithmically subdivided indices. An external output of 0 to 10 Vdc covering the full five decades of current, is available via the multipin connector on the rear of the instrument. (WHK)

16699 (WANL-TME-1283) OPERATIONAL MANUAL AND ACCEPTANCE TEST PROCEDURES FOR WANL NERVA LOG MICROAMMETER. Hardies, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 26p. Dep. NTIS $4.50.

This operational manual contains the general description, theories of operation, alignment procedures, maintenance and repair data, and interconnection diagrams for the WANL NERVA Log Microammeters. The WANL-NERVA Microammeter is a rack mounted, wholly self-contained, transistorized electronic measuring device. It displays (via an eight decade meter) a current proportional to the logarithm of the input current in the 10^{-10} to 10^{-2} ampere range. These eight decades of power build-up are displayed on a meter scale divided into eight equally spaced but logarithmically subdivided indices. An external output of 0 to 10 Vdc covering the full eight decades of current, is available via the multipin connector on the rear of the instrument. (WHK)

16700 (WANL-TME-1289) NON-NUCLEAR QUALIFICATION TESTING OF IMPROVED DESIGN OF PHYSICAL SCIENCES PRESSURE TRANSDUCERS. Simoncini, M. V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 26p. Dep. NTIS $4.50.

The results of the non-nuclear testing performed on improved models of Physical Sciences variable reluctance type pressure transducers are presented. Analysis of the data from the tests reveal that: (1) Model PT1015 absolute pressure transducer has greatly improved temperature characteristics as compared to the earlier Models PT1001 and PT1007. However, the change in zero output due to a thermal shock is greater than 10% F.R. WANL specification. (2) The changes made to Model PT1015 to produce PT1008 have not improved the thermal shock characteristics of the transducers. (3) The design of the transducers appears good, but better controlled inspection and manufacturing processes are required. (4) These transducers are unacceptable for NERVA application as they are. (5) Design changes should not be made until Physical Sciences has obtained reasonable performance from the present design. (auth)

16701 (WANL-TME-1302) THERMOCOUPLE SHEATH DEVELOPMENT DURING CONTRACT YEAR 1965. Instrumenttion Development Task T-3. Remley, G. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Sep 1965. 8p. Dep. NTIS $4.00.

Work performed in the Instrumentation Development Section during CY 1965 to obtain a sheath for high temperature core element thermocouples that will protect the thermoelements and insulation against degradation by the NERVA Reactor environment is summarized. The "Interim Report on Thermocouple Sheath Development" published as WANL-TME-1176 dated May 1965 should be considered as being part of this report. As a result of this work performed during CY 1965 bare molybdenum has been qualified as a sheath material for core element thermocouples for application up to 3660°R. It has also been established that this temperature is the maximum reactor application temperature for this material. Molybdenum coated with tungsten by vapor deposition has been qualified for application up to 4000°R. However, the ultimate upper limit of temperature application for this material has not yet been established. Tantalum has been disqualified as a sheath material as reliable methods of preventing catastrophic failure of this metal by hydriding have not yet been discovered. Core element installation lengths of both vapor deposited and wrought (extruded) tungsten and tungsten-26 per cent rhenium alloy tubing have been procured for evaluation. Specimens of tungsten, tantalum and molybdenum tubing with a protective coating of crystalline magnesium oxide have been procured and will be subjected to simulated reactor environment conditions to determine the protective ability of the coating. (auth)

16702 (WANL-TME-1309) OPERATIONAL MANUAL FOR TEST STAND CONTROL SYSTEM PULSE CALIBRATOR. Bush, N. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1965. 25p. Dep. NTIS $4.25.

This operational manual contains the general description, theory of operation, alignment procedures, and maintenance and repair data for the ETS-1 Pulse Calibrator. The ETS-1 Pulse calibrator generates voltage pulses of about 100 nsec width from 0.01 Hz to 1 mHz (similar to the current waveform from a BF_3 counter). (WHK)

16703 CALORIMETER. Meniere, J. M.; Patin, H. (to Commissariat l'Energie Nuclear). French Patent 2,170,795/A/. 1 Feb 1972. 11p. (In French).

The calorimeter according to the invention is characterized in that it comprises a calorimetric block consisting of a metal vat filled with water kept at a constant temperature, a heat-insulating enclosure surrounding said vat and a measuring cell mounted inside said block and containing a thermal flux source, said cell comprising a metal cylinder surrounding the source, a first winding formed of an electrically conductive wire and wound about the cylinder surface, a sheath acting as a thermal shield, and a second winding, the electrical resistance of which is the same as that of the first winding, said second winding being in contact with the calorimetric block water. (FR)

16704 WIDE-TIME RANGE PULSE RADIOLYSIS SYSTEM OF PICOSECOND TIME RESOLUTION. Jonah, C. D. (Argonne National Lab., IL). Rev. Sci. Instrum.; 46: No. 1, 62-66(Jan 1975).

A stroboscopic pulse radiolysis system is described which detects the transient absorption generated by a 20 psec pulse from a 20 MeV linear accelerator. The time resolution is obtained by using, as the analyzing light, the short pulse of Cherenkov light generated by the portion of the electron beam which passes through xenon. The remaining portion of the electron beam is delayed by passing around a 270° magnet and the delay of the light may be varied by an optical delay line. Block diagrams for the electronics and the optics are given. The magnitude of sources of errors is discussed. (auth)

16705 SIMPLE SCATTERING CHAMBER FOR MEASUREMENTS OF THE ANGULAR DISTRIBUTION OF DISSOCIATION PRODUCTS PRODUCED BY ION IMPACT. McKnight, R. H. (Univ. of Virginia, Charlottesville). Rev. Sci. Instrum.; 46: No. 1, 98-99(Jan 1975).

A scattering chamber for use in atomic collisions experiments is described which utilizes a simple sliding seal and which has an angular range of 20 to 160°. (auth)

16706 COMPUTER SYSTEMS FOR NUCLEAR MEDICINE. Brown, D. W. (Univ. of Colorado Medical Center, Denver); Sorenson, J. A.; Tolbert, D. D. pp 161-201 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

The basic features, capabilities, and terminology of digital computers for use in nuclear medicine are discussed. Computer hardware and software are discussed and applications are reviewed such as computer-assisted instruction, radionuclide inventory control, and the keeping of patient's records and reports. (WHK)

16707 NEW COMPACT MOLECULAR BEAM VELOCITY SELECTOR. Este, G.O.; Hilko, B.; Sawyer, D.; Scoles, G. (Department of Physics, University of Waterloo, Waterloo, Ontario, N2L 3G1 Canada). Rev. Sci. Instrum. 46: No. 2, 223-225 (Feb 1975).

A new, compact, molecular beam velocity selector is described. It utilizes the same principle as the slotted disks velocity selectors but consists only of one disk incorporating a series of multichannel collimators. Advantages: simplicity, short length, light weight. Disadvantages: limited resolution and limited maximum speed selected. (auth)

16708 LASER INTERFEROMETER FOR REMOTE MEASUREMENTS OF DISPLACEMENTS IN NUCLEAR RADIATION FIELDS. Lakin, Yu.G.; Sizov, V.V.; Abakumova, R.N. (Moscow Engineering Physics Institute). Sov. J. Quantum Electron. 4: No. 6, 786-787 (Dec 1974).

An analysis is made of the methods for measuring the radiation—induced deformations of construction materials in a nuclear reactor channel with the aid of a laser interferometer. The interferometer represents the Michelson configuration with arms whose equality is ensured by a special adjustment device. Confocal cat's eye systems are used as reflectors. The laser interferometer is operated in such a way that both reflecting systems are placed in a line in the reactor channel, one being attached to the investigated sample. This ensures a considerable reduction in the errors associated with temperature. The difference between the optical paths due to the deformation caused by nuclear radiation is measured with a resettable electronic fringe counter. In this way, movements down to $\sim 0.16\ \mu$ can be detected. (auth)

16709 HIGH ENERGY (keV), LARGE ANGULAR RANGE, PRECISION ELECTRON SPECTROMETER FOR ATOMIC AND MOLECULAR TARGETS. Wellenstein, H. F. (Brandeis Univ., Waltham, MA); Schmoranzer, H.; Bonham, R. A.; Wong, T. C.; Lee, J. S. Rev. Sci. Instrum.; 46: No. 1, 92-97(Jan 1975).

An electron impact spectrometer for operation in the keV incident-electron energy range is described. The spectrometer operates between 20 and 60 keV incident-electron energy, utilizing both a low-resolution silicon surface barrier detector (5 keV FWHM), and a high-resolution (0.7 eV FWHM) Möllenstedt energy analyzer over a 1.7 keV energy loss range. It features a large angular scan range ($0 \leq \theta < 120°$), high target gas throughput (i.e., 19,000 l/sec for He and 13,000 l/sec for N_2 through a tube of 0.15 mm diam), and a wide range of incident-electron beam currents (0.1-400 μA) with a focused electron beam size of less than 200 μ FWHM over most of the current range. Careful measurements of the gas density profile of the target gas emanating from the nozzle are also reported. Results are presented for the Bethe surface of He and N_2. The latter example is reported here for the first time. In addition, the observation of the angular dependence of the Lyman–Birge–Hopfield band in N_2 (dipole forbidden) is compared with the dependence of a neighboring dipole allowed transition. (auth)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

16710 (GAT-785) UPRATING OF GENERAL ELECTRIC 5 kV SWITCHGEAR. Kunkle, H. C.; Jordan, E. C. (Goodyear Atomic Corp., Piketon, Ohio (USA)). 9 Dec 1974. Contract AT(33-2)-1. 36p. Dep. NTIS $4.00.

Uprating of General Electric 5 kV switchgear has been accomplished on a prototype by Goodyear Atomic Corporation personnel using forced-air ventilation in compliance with NEMA and ANSI standards for power switchgear assemblies. Before modification, the twenty-year-old switchgear exhibited a hot spot temperature rise of 58°C as a result of application of the nameplate continuous current rating of 2000 A on the main bus sections. After installation of two fans and several grills and louvers, the prototype switchgear assembly was capable of 3000 A with a hot spot temperature rise of 53°C on the main bus sections. The prototype modification was used to develop a standard uprating design, which is described, and which will be the basis for uprating modifications to G. E. switchgear at the three plant Atomic Energy Commission gaseous diffusion complex. (auth)

16711 (UCRL-76022) LASER ENRICHMENT OF URANIUM, WHY, HOW, AND WHEN. Snavely, B. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Sep 1974. 33p. (CONF-740968-1; IS-74697). Dep. NTIS $4.75.

From meeting of the directors of industrial research; New York, New York, USA (20 Sep 1974).

The economics and feasibility of uranium enrichment by lasers are discussed and depicted with 16 visual slides. (TFD)

16712 DEVICE FOR SAMPLING GAS FROM THE ROTATING BOWL OF CENTRIFUGES. Lascoux, P. (to Commissariat a l'Energie Nuclear). French Patent 2,182,586/A/. 19 Jan 1972. 12p. (In French).

A device for sampling gas from the rotating bowl of centrifuges is described, said device comprising a fixed axial shaft carrying at least one transfer tube connected to a transverse scoop in a sampling chamber. This device is characterized in that said scoop is movable between a retracted position in which it is fully contained in the shaft and an extended position in which it protrudes from said shaft further to a relative movement of said transfer tube with respect to the shaft. This device affords the controlled telescoping of the scoops into the fixed axial shaft to which they are connected, which permits the mounting and dismounting of the shaft and scoops through a narrow opening. (FR)

16713 ISOTOPE SEPARATION BY OPTICALLY PUMPED IONIZING COLLISIONS. Harris, S.E.; Lidow, D.B. (Microwave Laboratory, Stanford University, Stanford, California 94305). Appl. Phys. Lett. 26: No. 3, 104-105 (1 Feb 1975).

We propose a modification of the selective two—step photoionization technique which greatly improves its efficiency. A third species with a strong resonance transition is added to the mix of isotopes which it is desired to separate. Incident optical energy is radiatively and collisionally trapped in this catalytic species. Selective ionization of excited step one species is accomplished by long—range ionizing collisions. (auth)

16714 URANIUM ENRICHMENT: NOW AN INDUSTRIAL REALITY. Pecqueur, M.; Coates, J. H.; Mezin, M. (CEA, Paris). Bull. Inform. A.T.E.N. (Ass. Tech. Energ. Nucl.); No. 107, 5-20(May 1974). (In French).

After a summing-up of the uranium enrichment situation (supply and demand balance, processes available, supply strategies) the EURODIF project is presented. (FR)

16715 URANANREICHERUNG. (URANIUM ENRICHMENT). Becker, E. W.; Besse, G.; Massonne, J. Schriftenreihe des Deutschen Atomforums. Bonn, F.R. Germany; Deutsches Atomforum (1974). 71p. (In German).

From European meeting on chemical engineering and ACHEMA congress; Frankfurt am Main, F.R. Germany (20 Jun 1973).

With figs., tabs. and refs.

This booklet in the series of publications of the "Deutsches Atomforum" contains the lectures given at the "Tag des Deutschen Atomforums" on the occasion of the ACHEMA 1973 in Frankfurt/Main. (GE)

16716 COLD TRAP UNIT. Monroe, P. S.; Chervenak, M. C. III. (to United States Atomic Energy Commission). US Patent 3,853,507. 10 Dec 1974. Filed date 31 Dec 1947. 6p.

A cold trap for the solidification and removal of uranium hexafluoride from inoperable sections of a gaseous diffusion cascade is described. (TFD)

Isotopic Power Sources

16717 (BNWL-1845-1) STRONTIUM FLUORIDE COMPATIBILITY PROGRAM. Quarterly Report for Period Ending June 30, 1974. Fullam, H. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-1830. 21p. Dep. NTIS $5.45.

The strontium fluoride compatibility program was reinstated in March 1974 under the technical direction of the Division of Space Nuclear Systems. Work is underway to complete the four series of short-term compatibility tests (up to 6 months duration) which were stopped when the program was terminated at the end of FY73. In the tests nine containment materials are being evaluated with four different grades of SrF_2 at 800, 1000 and 1100°C. The first series of tests with high-purity nonradioactive SrF_2 has been completed and couple interaction evaluated. The second series of tests with high-purity $^{90}SrF_2$ has been completed and the couples are being evaluated. The third series of tests with $^{90}SrF_2$ prepared by the Waste Encapsulation and Storage Facility (WESF) flowsheet (at PNL) has also been completed and the couples are now being evaluated. The fourth series of tests using high-purity nonradioactive SrF_2 with controlled levels of added impurities are now underway. The 1500-h tests have been completed and the 4400-h tests will be complete in Oct. Based on the results of the short-term tests, three containment materials will be selected for long-term compatibility testing. Work has started on a thermodynamic analysis of potential reactions between SrF_2, its decay product, contained impurities and the nine containment materials under consideration; a computer program has been developed to make the necessary free energy calculations. Evaluation of the compaction and sintering characteristics of SrF_2 is underway. SrF_2 compacts readily and 25% of theoretical density can be achieved by cold pressing at 10 tons/in.^{2}. Sintering characteristics of SrF_2 at temperatures up to 1100°C are largely determined by the impurities present, especially NaF. At 1100°C SrF_2 powder containing about 2 wt % Na sintered to a hard, dense mass having a bulk density of about 60% of theoretical density. Work has started on measuring the dissolution rate of SrF_2 in aqueous media. Preliminary results obtained, using a static (nonflow) test system, were unsatisfactory due to analytical limitations. A dynamic (flow) test system is now being used which provides a more reliable measure of the dissolution rate. Initial results with the system indicate a dissolution rate of about 35 μg Sr/h-g SrF_2 for high-purity nonradioactive SrF_2 fired at 1100°C. (auth)

16718 (BNWL-1845-3) PACIFIC NORTHWEST LABORATORY QUARTERLY REPORT ON SPACE NUCLEAR SYSTEMS PROGRAM FOR JULY—SEPTEMBER 1974. Fullam, H. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-1830. 28p. Dep. NTIS $4.00.

At Hanford, strontium will be separated from the high-level waste, converted to the fluoride, and doubly encapsulated in small, high-integrity containers for subsequent long-term storage. The fluoride conversion, encapsulation and storage will take place in the Waste Encapsulation and Storage Facilities (WESF). The encapsulated strontium fluoride represents an economical source of ^{90}Sr if the WESF capsule can be licensed for heat source applications under anticipated use conditions. The objectives of this program are to obtain the data needed to license $^{90}SrF_2$ heat sources and specifically the WESF $^{90}SrF_2$ capsules. The information needed for licensing can be divided into three general areas: (1) long-term SrF_2 compatibility data; (2) chemical and physical property data on $^{90}SrF_2$; and (3) capsule property data such as external corrosion resistance, crush strength, etc. The current program is designed to provide the required information. (auth)

16719 (DPST-74-128-11) SAVANNAH RIVER LABORATORY MONTHLY REPORT: ^{238}Pu FUEL FORM PROCESSES. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nov 1974. Contract AT(07-2)-1. 22p. Dep. NTIS $4.25.

Twenty pure plutonium oxide (PPO) pellets were made in four hot pressings in new multi-punch die sets. Densities within PPO specifications were easily obtained. In studies of the effects of process variables on shard fabrication: cold-pressed density was very reproducible for a given powder batch and pressure; and differences in cold-pressed density are reduced by sintering, and the sintered density is primarily a function of sintering temperature. (auth)

16720 (ORNL-5009) ORNL ISOTOPIC POWER FUELS QUARTERLY REPORT FOR PERIOD ENDING JUNE 30, 1974. Ottinger, C. L. (Nancy Univ., 54 (France). Lab. de Physique Theorique et d'Astrophysique). Dec 1974. 39p. Dep. NTIS $4.00.

Examination of $^{244}Cm_2O_3$ compatibility couples continued with inspection of materials exposed at 900°C and at 1400°C. All of the test materials exposed to $^{244}Cm_2O_3$ at 1400°C for 5000 h showed some interaction. These included both iridium and graphite, neither of which had shown reaction at lower temperatures. Attempts to fabricate thin rectangular pellets of $^{244}Cm_2O_3$ for use in combined compatibility/tensile strength tests were unsuccessful, and this phase of the compatibility work was terminated. The calculational thermodynamic reaction study phase was completed. Total normal emittance measurements were made on a $^{244}Cm_2O_3$ pellet in the temperature range from 725°C to 1175°C. Normal spectral emittance values were determined on the same pellet in the 3.0 to 5.5μ wavelength range at three temperatures. Heat capacity measurement work was initiated. Some nonradioactive demonstration runs of a technique for hot pressing metal-jacketed pellets were made. Literature surveys, calculations, and preliminary experimental work on ^{244}Cm recovery from fuel reprocessing wastes continued. The first step, feed conditioning, was investigated experimentally; and a study was performed of the applicability of the TALSPEAK process and its modifications to the ^{244}Cm recovery problem. Design of experimental equipment was started. (auth)

16721 (ORO-4485-2) ARTIFICIAL HEART CONTROLS SUPPORT. Final Report, August 1, 1973–July 31, 1974. Donovan, F. M. Jr. (Universities Center, Jackson, Miss. (USA)). 1974. Contract AT(40-1)-4485. 83p. Dep. NTIS $7.25.

Detailed design information concerning power and control requirements for the intermediate nuclear powered artificial heart system is presented. The U. S. population was divided into 648 different segments based on age, weight, height and sex. The basal cardiac output for each segment was calculated and compared to maximum output capability of the artificial heart to obtain cardiac reserve. The work capacity of each segment was determined and used to categorize the segments. The proportion of the adult U. S. population falling into each category was determined from census data. The activity limitations of each category were investigated. With a 12 liter/min artificial heart virtually none of the adult U. S. population would be appreciably limited in activity. With moderate anemia practically all of the population would be eligible for support and be restricted to sedentary to moderately active life style. With severe anemia about 1% of the population could not be supported and the rest would be severely restricted in their activities. Reducing the maximum cardiac output of the artificial heart by 3 liter/min has roughly the same effect as moderate anemia and reducing it by 6 liter/min has the same effect as severe anemia. In the absence of energy storage the nuclear powered artificial heart must be capable of supplying 3.07 watt of blood power for an indefinite period of time. With energy storage the heart must be able to supply 2.3 watt of blood power for an indefinite period of time with a maximum of 3.07 watt for shorter periods. Regulation of cardiac output in response to atrial pressure is sufficient steady state control provided that the output can go from 5 to 12 liter/min without requiring the atrial pressure to go below –2 mmHg nor above +10 mmHg. The artificial heart must be capable of responding to relatively small changes in atrial pressure within one heart beat and be able to go from 5 liter/min to 12 liter/min within about one minute. (auth)

Radiation Sources

Design and Fabrication

16722 (INIS-mf–1273) DESIGN AND CONSTRUCTION OF A PHOTONEUTRONIC Sb–Be SOURCE AND ITS USE AT TEACHING LABORATORIES. Morales, G. L. E. (Instituto Technologico y de Estudios Superiores de Monterrey (Mexico)). 1973. 123p. (In Spanish). INIS.

Thesis.

Two photoneutron Sb–BeO sources with fluxes of the order of 10^5 and 10^6 n/sec were designed. These sources consist essentially of a sealed cylindrical container of metallic Sb which is introduced into another vessel containing BeO. The difference between these sources comes from the difference in the dimensions of the BeO container. This coaxial cylindrical arrangement emits neturons for the (γ,n) reaction in Be. The analysis of the neutron flux was made by two different activities in the Sb. In the calculation of the γ activity, thermoluminescent dosimeters and the Teletector Eberline were used. The method used in the calculation of the neutron flux was activation analysis. Some experiments which justify the use of this neutron source in the Ensenanza Laboratories are reported. (tr-auth)

16723 SET OF RADIOACTIVE SOURCES FOR CANCER TREATMENT. Rebigan, F.; Sandu, M.; Sandulescu, T. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 5, 583-587(1974). (In Rumanian).

The theoretical principles and practical criteria leading to a special technology of manufacturing sealed radioactive sources of cobalt-60 are given. A description of the set is presented as well as its main characteristics. The tests to which the sources were subjected are briefly described. (auth)

16724 IMPROVEMENTS TO DEVICES FOR THE MAGNETIC DEFLECTION AND FOCALIZATION OF A PARTICLE BEAM AND IRRADIATION EQUIPMENT COMPRISING SUCH A DEVICE. Leboutet, H. (to Thomson-CSF). French Patent 2,169,746/A/. 31 Jan 1972. 14p. (In French).

By means of the device described in the invention, it is possible to focus simultaneously a beam of accelerated particles along two planes at right angles to each other in a target of predetermined position, whatever may be the energy of said particles. This device comprises two electromagnets E_1, and E_2 whose input and output faces are parallel, and a third electromagnet E_3, whose input and output faces define an angle γ. The various parameters determining the dimensions and relative position of the electromagnets are connected by relations established in the specification. This device has many applications in the field of physical and biological research, as well as in the field of radiating medical devices. (FR)

Industrial Uses

Refer also to abstract 16652.

16725 (BNWL-B–13) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO THE DIVISION OF ISOTOPES DEVELOPMENT FOR AUGUST 1970. Hansen, J. E. (ed.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Sep 1970. Contract AT(45-1)-1830. 15p. Dep. NTIS $4.00.

16726 (BNWL-B–23) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO THE DIVISION OF ISOTOPES DEVELOPMENT FOR SEPTEMBER 1970. Hansen, J. E. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Oct 1970. Contract AT(45-1)-1830. 19p. Dep. NTIS $4.00.

16727 (BNWL-B–36) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO THE DIVISION OF ISOTOPES DEVELOPMENT FOR OCTOBER 1970. Hansen, J. E. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Nov 1970. Contract AT(45-1)-1830. 22p. Dep. NTIS $4.25.

16728 (BNWL-B–43) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO THE DIVISION OF ISOTOPES DEVELOPMENT FOR NOVEMBER 1970. Hansen, J. E. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Dec 1970. Contract AT(45-1)-1830. 19p. Dep. NTIS $4.00.

16729 (BNWL-B–67) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO THE DIVISION OF ISOTOPES DEVELOPMENT FOR FEBRUARY 1971. Hansen, J. E. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). [nd]. Contract AT(45-1)-1830. 27p. Dep. NTIS $4.50.

16730 (BNWL-B–95) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT TO THE DIVISION OF ISOTOPES DEVELOPMENT FOR APRIL 1971. Hansen, J. E. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 May 1971. Contract AT(45-1)-1830. 27p. Dep. NTIS $4.50.

16731 (BNWL-B–194) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT ON ISOTOPES DEVELOPMENT PROGRAMS FOR JUNE 1972. Jarrett, J. H. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 17 Jul 1972. Contract AT(45-1)-1830. 20p. Dep. NTIS $4.00.

16732 (BNWL-B–206) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT ON ISOTOPES DEVELOPMENT PROGRAMS FOR JULY 1972. Jarrett, J. H. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 17 Aug 1972. Contract AT(45-1)-1830. 23p. Dep. NTIS $4.25.

16733 (BNWL-B–212) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT ON ISOTOPES DEVELOPMENT PROGRAMS FOR AUGUST 1972. Jarrett, J. H. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Sep 1972. Contract AT(45-1)-1830. 20p. Dep. NTIS $4.00.

16734 (BNWL-B-222) PACIFIC NORTHWEST LABORATORY MONTHLY REPORT ON ISOTOPES DEVELOPMENT PROGRAMS FOR SEPTEMBER 1972. Jarrett, J. H. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 16 Oct 1972. Contract AT(45-1)-1830. 23p. Dep. NTIS $4.25.

16735 (IAEA-R-839-P) IRRADIATION PRESERVATION OF KOREAN FISH AND SHELLFISHERY PRODUCTS. Final Report, 1 January 1970-31 December 1972. Chung, J. R.; Kim, S. I. (International Atomic Energy Agency, Vienna (Austria)). Oct 1973. 74p. INIS.

To achieve radiation of some Korean fish and shellfish for shelf-life extension under low temperature storage, a 3-year study was undertaken to determine those species that are economically and technologically feasible for processing by irradiation. Five species of fish, namely croaker (Nibera imbricate), yellow corvenia (Pseudoscianea manchuria), round-nose flounder (Xystria grigorijewi), carp (Cyprinus carpio), and rainbow trout (Salmo gairdneric), and 3 species of shellfish including Pacific oyster (Crassostrea gigas), hard clams (Meretrix lusoria), and mussel (Mytilus edulis) were irradiated at doses below 0.5 Mrad with the exception of carp, which received doses up to 1.5 Mrad. Post-irradiation storage was carried out at 0 and 5°C for a period of 35 days. Sensory evaluations were made at periodical intervals during storage. Besides, total bacterial counts, total volatile bases and trimethylamine were estimated. Pyrosine content assessment and drip loss studies were undertaken for carp and trout. Carp, Pacific oyster, and mussel appear to be the promising Korean fish and shellfish species for preservation by low-dose irradiation. (INIS)

16736 (INIS-mf-1284) SOME APPLICATIONS OF TRACER TECHNIQUES IN INDUSTRY. Rodriguez, A. G. (Instituto Tecnologico Regional de Veracruz (Mexico)). 1973. 66p. (In Spanish). INIS.

Thesis.

The fundamentals of radioactivity and the application of radiotracers to the resolution of some problems found in industrial processes are analyzed. The α, β, and γ radiations and their detection and methods of protection against them are briefly studied. The determination of the quantity of a substance by the isotopic dilution method, determination of the average residence time of a fluid in vessels with constant flow and agitation, determination of the optimum mixing time, detection of catalyst loses, detection of leaks, and design of an ideal chemical reactor are analyzed. (tr-auth)

16737 DETERMINATION OF THE WEATHERING OF ALKYD RESIN PAINT COATS PIGMENTED WITH TiO_2 BY MEANS OF ^{32}P-PHOSPHATE ADSORPTION. Mende, G. Farbe Lack; 79: No. 8, 756-761(1973).

Using ^{32}P-phosphate adsorption on alkyd resin paints pigmented with TiO_2 as an example, a description is given, for the first time, of how the pigment concentration on the surface of weathered paints may be determined by means of the radionuclide adsorption from aqueous solutions. This is used as a criterion for comparing the weatherability of various paints. This permits the determination, e.g., of how the weathering of paints coats depends on the type of pigment. (Corros. Abstr.)

16738 PNEUMATIC DEVICES IN ISOTOPES TECHNOLOGY. I. Egri, B.; Csoke, A. (MTA Kozponti Fizikai Kutato Intezete, Budapest). Izotoptechnika; 17: No. 11, 535-544(Nov 1974). (In Hungarian).

Working cylinders, membrane motors, valves, detectors, and hydropneumatic units are discussed. (auth)

16739 METHOD FOR CONTROLLING THE TIGHTNESS OF SEALS AND DEVICE FOR CARRYING OUT SAID METHOD. Guizerix, J.; Margrita, R.; Mornas, A.; Mayet, R. (to Commissariat a l'Energie Nuclear). French Patent 2,178,424/D/. 31 Mar 1972. 20p. (In French).

A method for controlling the tightness of seals which undergo high liquid (e.g., water) pressures is described. The method comprises submitting the seal to an outer pressure of tritium-labelled water and to a sweeping liquid. The activity n of a portion eta, of part sweeping liquid is measured according to any appropriate method, then compared with the known activity n_0 of a given volume v of said tritium-labelled water, the water volume X which has seeped through the seal being: $X = v.n/n_0.eta$. Through said method, it is possible to detect leaks of about 10^{-6}g per day, in a seal submitted to a pressure of 100 bars for 24 h. (FR)

16740 ELECTRON BEAM METHOD OF DRYING PAINTS AND VARNISHES. III. Course of Instruction on Corrosion. Gaussens, G. (CEN de Saclay, Gif-sur-Yvette, France). pp 1-16 of Thirdcourse of Instruction on Corrosion. Rueil-Malmaison, France; Centre de Perfectionnement Technqiue (1974). (In French)

From 3rd course of instruction on corrosion; Paris, France (10 Jun 1974).

The electron beam method of drying paints and varnishes is presented. The apparatus used (100 to 500 keV electron accelerators) and the irradiation technology are described. The influence of the nature and concentration of the monomer, the influence of the degree of non-saturation of the basic polymer and its composition and the effect of the dose rate are examined. (FR)

16741 THIN LAYER ACTIVATION BY ACCELERATED IONS FOR MEASUREMENT OF INDUSTRIAL WEAR. Conlon, T. W. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Non-Destruct. Test. (Guildford, Engl.); 7: No. 6, 310-314(Dec 1974).

The use of the thin layer activation technique in measuring surface loss of materials due to wear and corrosion with particular reference to iron and steels is described. The active layer is usually 30 to 300 μm thick and the sensitivity of the method is about 0.5 μm. However, the potential exists for active layers as small as a few μm and as large as about 30 mm to be produced and monitored during the wear process. Activity depth distributions resulting from the irradiation of such common industrial materials as iron, copper, aluminium and carbon by various charged particle beams have been calculated. The technique described is applicable to these materials and composites containing them, e.g., ceramics and plastics, and to many other elements including silicon, glasses, enamels, and abrasives. (auth)

16742 PESTICIDES IN COMPOST. Polychlorated Biphenyl (PCB) Are Hardly Decomposed by Composting. Firnhaber, R. B. VDI (Ver. Deut. Ing.) Nachr.; 38: No. 37, 1-2(Sep 1974). (In German).

2 figs.

The composting of household refuge and sewage sludge is still valid as a relatively non-harmful way of refuse disposal. New investigations by the GSF show however, that in household refuge, sewage sludge and waste compost, pesticides such as polychlorated biphenyl (PCB), aldrin and DDT are present which are hardly decomposed by composting. This was shown by investigations with ^{14}C-labelled pesticides. Further investigations are to clarify the behavior of other dispersed foreign matter in composting. (auth)

16743 RADIOISOTOPE STUDIES OF CEMENT CORROSION. Tikhomirova, M. F.; Cherkasov, G. F.; Pankrashova, V. D.; Tyagunova, E. S. (Urals Industiral Construction Project, Sverdlovsk, USSR). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 7, 990-992(Jul 1974).

Translated from Zavod. Lab., 816-819(Jul 1974).

A rodiotracer method for measuring the penetration of solutions into concretes is presented. The method was applied to sulfate solutions using ^{35}S to monitor the anion and radioactive metals to monitor the cations. (TFD)

LIFE SCIENCES

Radiation Effects on Biochemicals

Refer also to abstracts 16824, 16960, 19147, 19150, and 19156.

16744 (TID-26710) CHEMICAL KINETICS OF IONIZING RADIATION: INDIRECT ACTION. Fluke, D. J. (Duke Univ., Durham, N. C. (USA). Dept. of Zoology; Rijksuniversiteit Utrecht (Netherlands)). [nd]. 35p. Dep. NTIS $4.75.

The indirect effects of ionizing radiations on biological materials were investigated in an effort to establish dose-effect relations for radiation injuries. Data are reviewed from studies on the radioinduced inactivation of enzymes, hormones, active nucleic acids, and other biologically active materials in aqueous solutions. An attempt was made to establish the kinetics of chemical reactions in relation to the radiation dose. (CH)

16745 PHOTOREACTIONS OF 5-BROMOURACIL IN THE PRESENCE OF CYSTEINE AND GLUTATHIONE. Varghese, A. J. (Ontario Cancer Inst., Toronto). Photochem. Photobiol.; 20: No. 5, 461-464(Nov 1974).

Sulfhydryl compounds such as cysteine and glutathione enhanced the photochemical reactivity of 5-bromouracil irradiated in aqueous solution with ultraviolet light ($\lambda > 240$ nm). Production of uracil and addition of the sulfhydryl compound to the 5-bromouracil residue were the major photoreactions. (auth)

16746 QUANTUM YIELDS IN THE UV PHOTOLYSIS OF 5-BROMOURACIL IN THE PRESENCE OF HYDROGEN DONORS. Campbell, J. M.; Schulte-Frohlinde, D.; von Sonntag, C. (Max-Planck-Institut fuer Kohlenforschung, Muelheim, Ger.). Photochem. Photobiol.; 20: No. 5, 465-467(Nov 1974).

The uv photolysis of solutions of 5-bromouracil (5BrUra) was studied to explain the discrepancy, by an order of magnitude, between the published quantum yield of single-strand breaks (Φ(ssb.)) for the photolysis of aqueous solutions of 5BrUra-DNA in T3 phage and that of the destruction of 5BrUra itself (Φ(–5Br Ura)) in aqueous solutions. In the solvents studied, Φ(–5BrUra) was found to be independent of scavenger type and concentration over a wide range, but at high scavenger concentration (eg. > 5M methanol) a dramatic increase in Φ(–5BrUra) was observed. The maximum values were in the range 5.5×10^{-3} to 45×10^{-3} and depended on the solvent, being much higher in pure H donor solvents than in water. It was therefore concluded that the high Φ(–5BrUra) and Φ(ssb.) values observed in 5BrUra-DNA photolysis, even in aqueous solutions, are due to efficient cage scavenging by the neighbouring sugar molecule; this sugar radical then ultimately leads to a single-strand break with uracil adjacent to the break. (UK)

Radiation Effects on Cells

Refer also to abstracts 16795, 16796, and 19154.

16747 (AEC-tr-7596, pp 166-170) INFLUENCE OF LOW VALUES OF THE ABSORBED DOSES OF GAMMA RADIATION ON THE GROWTH OF NORMAL FIBROBLASTS. Dobrachev, Yu. P.; Andreev, S. V. (Pyatigosk and Central Scientific Research Institutes of Spa Therapy and Physiotherapy, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 443-446(1974). In Radiobiology.

Cultures of embryonic rat fibroblasts were grown in slanted test tubes containing 2 ml of medium. For the irradiation of the culture, medium 199 enriched with radon was added to the test tube. In addition to the radiation of the radon, the radiation of the daughter products must be considered. The dose characteristics obtained permit an estimation of the effectiveness of the stimulation in the course of the experiment as a function of the absorbed dose. The lack of correspondence of the low values of the doses absorbed by the cells to the substantial effect of stimulation confirms the hypothesis that the positive effect cannot be the result of the direct action of alpha particles on the cell. (ERB)

16748 (COO-3521-129) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 1. Radiation Studies: Theoretical Investigation of LET Spectra and Dose Relationship Progress Report, May 1, 1971 – April 30, 1973. Laughlin, J. S.; Kessaris, N. D. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 31 May 1973. Contract AT(11-1)-3521. 12p. Dep. NTIS $4.00.

Studies on high-intensity pulsed radiations included analysis and testing of a biophysical model of oxygen diffusion into a monocellular aqueous layer after exposure to an ultra-high intensity pulse of electrons. RBE and OER studies in water were conducted to obtain a quantitative description of the dependence of RBE and OER on the spectrum of LET at various points in a tissue-like medium arising from a variety of cyclotron-produced neutron beams. (HLW)

16749 (COO-3521-130) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 2. Radiation Studies: Radiation Mechanisms in Mammalian Systems. Progress Report, January 1, 1972 – May 1, 1973. Laughlin, J. S.; Djordjevic, B.; Fried, J. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 31 May 1973. Contract AT(11-1)-3521. 9p. Dep. NTIS $4.00.

Investigations were conducted on the effect of oxygen on mammalian cells exposed to radiation of different LET. OER values were determined for hypoxic HeLa cells exposed to 280 kvp x rays, neutrons, and ^{252}Cf sources. Studies were also conducted on radiosensitivity of cell lines whose proliferation is highly sensitive to cell population density and serum factors. DNA synthesis was almost completely suppressed when cells were exposed to an x-ray dose of 1000 rads. (HLW)

16750 (SGAE-2331) DNA-REPAIR IN CELLS AFTER NEUTRON OR GAMMA IRRADIATION. Tuschl, H.; Klein, W.; Kocsis, F.; Kovac, R.; Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Aug 1974. 12p. (CONF-740715-22; BL-105/74). Dep. NTIS (US Sales Only) $4.00.

From 5th international radiation research congress meeting; Seattle, Washington, USA (14 Jul 1974).

Unscheduled DNA-synthesis was investigated in spleen cells after gamma and fast neutron irradiation by autoradiography, and rejoining of DNA strand breaks by alkaline sucrose gradient centrifugation. Up to 30 krad neutrons unscheduled DNA-synthesis could be demonstrated, while strand rejoining occurred up to doses of 15 krad. Semiconservative DNA synthesis was measured after various irradiation doses, the amount of suppression exhibits good correlation with radiation dose. (auth)

16751 CELL PROPERTIES AFTER REPEATED TRANSPLANTATION OF SPONTANEOUSLY AND OF SV40 VIRUS TRANSFORMED MOUSE CELL LINES. I. Growth in Culture. McFarland, V. W.; Mora, P. T.; Schultz, A.; Pancake, S. (National Institutes of Health, Bethesda, MD). J. Cell. Physiol.; 85: No. 1, 101-111(Feb 1975).

Spontaneously or SV40 virus transformed AL/N mouse cell lines were passed repeatedly through syngeneic mice. Cell lines were re-established in culture from minced pieces of tumors in the presence of concentrated fetal calf serum or from tumor cells dispersed by trypsin. The aim of this study was to compare the two cell lines in regard to the selection processes which operate during such procedures by characterization of the resulting cell lines. Measurements of growth in tissue culture on substratum showed no significant difference between any of the transformed cell lines. The SV40 transformed cells and its derivative cells had a low anchorage requirement for growth. The greatest anchorage requirement for growth was in the normal untransformed cells and in the derivative cells from the "spontaneously" transformed cells which were established from minced tumors. The spontaneously transformed cells and all derivative cells had high tumorigenicity in vivo ($TD_{50} < 10^2$). The SV40 transformed cells had no observable tumorigenicity ($TD_{50} > 10^8$), except when injected into irradiated mice ($TD_{50} = 10^7$). The derivative cell lines obtained from such a tumor had increased tumorigenicity ($TD_{50} = 1 - 5 \times 10^5$ in the immunocompetent mice, 5×10^4 in the irradiated mice). The SV40 transformed derivative cells maintained their SV40 specific T antigen and their susceptibility to lysis by specific antiserum. (auth)

16752 INDUCTION AND ANALYSIS OF GENE MUTATIONS IN CULTURED MAMMALIAN SOMATIC CELLS. Chu, E. H. Y. (Univ. of Michigan, Ann Arbor). Genetics; 78: No. 1, 115-132 (Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

Despite considerable work it is in many instances unclear whether the mutant cell lines that can be isolated from mammalian cells in culture are due to genetic or epigenetic mechanisms. Available evidence was reviewed to assess whether consistent phenotypic variations in mammalian somatic cell populations in culture are true gene mutations. By the efforts of many investigators, selective procedures were devised to isolate mutant clones with a variety of changed phenotypes such as nutritional requirements, drug resistance, and conditional lethality. By a number of criteria, these isolated mutant clones appear to fulfill the properties of gene mutations. These criteria for genetic alterations include random occurrence, retention of stable phenotype in the absence of selection, induction with mutagens, mutagenic specificity, conditional lethality, interallelic complementation and changes in the activity as well as the physiochemical properties of specific gene products. The question of the nature of variants in somatic mammalian cells appears to be confronted with doubts and uncertainties. There is published information on the drug resistance in mammalian cells that is difficult to explain in conventional genetic terms, yet evidence, as summarized in this paper, is persuasive that many, if not all, markers are governed ultimately by information in the cellular genome. Of course, other alternative possibilities have not been ruled out. For instance, drug resistance may be a special case which might reflect the occurrence of cytoplasmic as well as nuclear inheritance. A resolution of this apparent conflict between the genetic and epigenic interpretations for the origin of variation in mammalian cells in culture requires further careful and rigorous investigations. (HLW)

16753 DNA DAMAGE AND REPAIR IN EUKARYOTIC CELLS. Painter, R. B. (Univ. of California, San Francisco). Genetics; 78: No. 1, 139-148(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

Damage in DNA after irradiation can be classified into five kinds: base damage, single-strand breaks, double-strand breaks, DNA–DNA cross-linking, and DNA-protein cross-linking. Of these, repair of base damage is the best understood. In eukaryotes, at least three repair systems are known that can deal with base damage: photoreactivation, excision repair, and post-replication repair. Photoreactivation is specific for uv-induced damage and occurs widely throughout the biosphere, although it seems to be absent from placental mammals. Excision repair is present in prokaryotes and in animals but does not seem to be present in plants. Post-replication repair is poorly understood. Recent reports indicate that growing points in mammalian DNA simply skip past uv-induced lesions, leaving gaps in newly made DNA that are subsequently filled in by de novo synthesis. Evidence that this concept is oversimplified or incorrect is presented. Single-strand breaks are induced by ionizing radiation but most cells can rapidly repair most or all of them, even after supralethal doses. The chemistry of the fragments formed when breaks are induced by ionizing radiation is complex and poorly understood. Therefore, the intermediate steps in the repair of single-strand breaks are unknown. Double-strand breaks and the two kinds of cross-linking have been studied very little and almost nothing is known about their mechanisms for repair. The role of mammalian DNA repair in mutations is not known. Although there is evidence that defective repair can lead to cancer and/or premature aging in humans, the relationship between the molecular defects and the diseased state remains obscure. (auth)

16754 OSMOTIC PROPERTIES AND MORPHOLOGICAL CHANGES OF SUBMICROSCOPIC SURFACE STRUCTURES OF MAMMALIAN RED BLOOD CELLS SUBJECTED TO UV-IRRADIATION IN VITRO. Kabat, I. A. (Akademia Medyczna, Lodz (Poland). Katedra Fizjologii); Leyko, W. (Lodz Univ. (Poland). Dept. of Biophysics); Kwiatkowski, B.; Zakrzewska, I. (Akademia Medyczna, Gdansk (Poland). Dept. of Biophysics). Zentralbl. Bakteriol., Parasitenk., Infektionsk. Hyg.; 159: No. 1, 88-94 (1974).

6 figs.; 2 tabs.; 19 refs.

Results of investigations on the effects of uv-irradiation in vitro on selected osmotic properties of pig, ox, and human blood cells and changes in their surface structures observed by electron microscope are presented. A reduction of hemolysis reversion degree under the influence of uv irradiation, an increased sensitivity of red blood cells as well as a decrease of their resistance to hypotonic solutions of NaCl were found. It was concluded that the observed osmotic changes correlate quite well with submicroscopic changes. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 16045 and 16796.

16755 (AEC-tr–7596, pp 62-67) PRINCIPLES OF THE FORMATION OF RADIORACES IN YEAST ORGANISMS. Communication 5. Evaluation of the Contribution of Respiratory Mutants to Radiation Race Formation. Bliznik, K. M.; Korogodin, V. I. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 369-373(1974).

In Radiobiology.

Respiratory mutants (RM), arising in diploid yeasts Saccharomyces ellipsoideus, strain Mergi 139-B, spontaneously and as a result of the influence of the gamma rays of ^{60}Co, were detected by a tetrazole method. Both in the control and after irradiation, RM of similar morphological groups arise. In the control the content of RM is less than 0.1 percent, while after irradiation their yield increases with the dose to 10 to 20 percent, so that RM account for 12 to 25 percent of all saltants. RM are more often encountered in the colonies that grow out of irradiated cells, which usually give rise to unstable radioraces. In inocula of such unstable races, an elevated (in comparison with the control) content of RM was noted even 3 years after their introduction into the irradiated cells. (tr-auth)

16756 (AEC-tr–7596, pp 68-74) EFFECTS OF HIGH-ENERGY HADRONS ON THE SURVIVAL OF THE BACTERIUM ESCHERICHIA COLI AND BACTERIOPHAGE T4Br^{+}. Akoev, I. G.; Yurov, S. S.; Leont'eva, G. A.; Livanova, I. A.; Lebedev, V. N.; Lukanin, V. S. (Inst. of Biophysics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 374-377(1974).

In Radiobiology.

It was shown in experiments on E. coli B and bacteriophage T4Br^{+} that the lethal action of the secondary radiation from 70 GeV protons, consisting cheifly of high-energy hadrons, possesses a greater relative biological effectiveness (RBE) than gamma irradiation with ^{137}Cs. The coefficient of the RBE for E. coli B is 5.1, for bacteriophage T4Br^{+} in buffer 3.2, and in broth 1.5 to 4.2. The role of strong interactions of high-energy nuclear particles in the radiobiological effects induced by secondary radiation from 70 GeV protons is discussed. (tr-auth)

16757 (AEC-tr–7596, pp 79-83) INFLUENCE OF A RADIOSENSITIZER (MONOIODOACETATE) ON THE REPAIR OF SUBLETHAL DAMAGES IN CELLS OF THE BLUE-GREEN ALGA ANACYSTIS NIDULANS. Dmitriev, A. P.; Grodzinskii, D. M. (Inst. of Plant Physiology, Kiev). 1974. Translated from Radiobiologiya; 14: No. 3, 382-385(1974).

In Radiobiology.

The influence of a radiosensitizer (monoiodoacetate, MIA) on the repair of sublethal damages was investigated on an asynchronous culture of cells of the single-celled blue-green alga Anacystis nidulans (strain 6301). It was shown that the effect of radiosensitization is less pronounced in the case of irradiation of cells with the second fraction of the dose. The incubation of irradiated cells with MIA during the interval between dose fractions evidently causes an inhibition of the repair of sublethal damages. (tr-auth)

16758 (AEC-tr–7596, pp 84-88) INFLUENCE OF DENSELY IONIZING RADIATION ON CHLORELLA. Vekshina, L. K.; Sakovich, I. S.; Shevchenko, V. A. 1974. Translated from Radiobiologiya; 14: No. 3, 386-389(1974).

In Radiobiology.

As a result of the difference in the shapes of the curves of inactivation of Chlorella during irradiation with a standard type of radiation (gamma quanta) and heavy ions with various specific linear energy losses, the coefficients of the relative biological effectiveness depend on the level of survival. A relationship of the type of death of Chlorella to the type of radiation has been demonstrated. The cross section of inactivation and its dependence on the linear energy losses were calculated. (tr-auth)

16759 (AEC-tr–7596, pp 104-106) PROGRESSIVE DISRUPTION OF PROTEIN SYNTHESIS AFTER ULTRAVIOLET IRRADIATION. Osakovskii, V. P.; Pavin, V. K. (Inst. of General Genetics, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 401-403(1974).

In Radiobiology.

Most of the damages to the cell as a result of uv irradiation consist of the formation of pyrimidine dimers in DNA, which is accompanied not only by a disruption of DNA synthesis, but also by a disruption of RNA and protein synthesis. There is some basis for believing that the disruption of protein synthesis immediately after uv irradiation is a consequence of the termination of transcription close to a dimer. This communication presents data indicating a progressive disruption of protein synthesis during postradiation incubation of uv-irradiated cells. (E. coli). (tr-auth)

16760 VARIATION OF MUTAGENIC ACTION OF NONSENSE MUTANTS AT DIFFERENT SITES IN THE ISO-1-CYTOCHROME c GENE OF YEAST. Sherman, F.; Stewart, J. W. (Univ. of Rochester, NY). Genetics; 78: No. 1, 97-113(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

Three ochre and two amber mutants in yeast were definitively identified by the amino acid replacements in iso-1-cytochromes c from intragenic revertants. Except for rare and sometimes unusual changes, all of the replacements were single amino acids whose codons differed from UAA or UAG by one base. These assignments, which were based on the absence of tryptophan replacements in ochre revertants, could be corroborated from the studies of two groups of suppressors that were shown to act on either the ochre or amber mutants. All five nonsense mutants are located at different sites in the cycl gene and all are at sites that can be occupied by amino acids having a wide range of structures. The relative frequencies of the amino acid replacements indicate that identical codons located at different sites may respond differently to a mutagenic agent. Notably glutamine replacements occurred almost exclusively in uv-induced revertants of only one ochre mutant cycl-9, but not at all or at reduced proportions in the others. Similarly, lysine replacements occurred almost exclusively in the NA-induced revertants of only the ochre mutant cycl-72, but not at all in the others. These and other results reveal that mutation of A · T base pairs by uv and nitrous acid are dependent upon the location of the codon within the gene as well as the location of the base pair within the codon. From these findings, it appears as if the type of base-pair changes induced by uv and nitrous acid are strongly influenced by adjacent nucleotide sequences. (auth)

16761 MISREPAIR MUTAGENESIS IN BACTERIOPHAGE T4. Green, R. R.; Drake, J. W. (Univ. of Illinois, Urbana). Genetics; 78: No. 1, 81-89(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

The T4 mutations px, y and 1206 inactivate an error prone recombination like repair system, reducing or abolishing mutagenesis by uv irradiation, MMS, and white light irradiation in the presence of the photosensitizer 8MOP. Both px and y increase some spontaneous mutation rates and slightly enhance proflavin mutagenesis; neither mutation affects thymineless or 2AP mutagenesis appreciably, but both mildly enhance 5BU mutagenesis. The mutation hm promotes uv, MMS, photodynamic, thymineless, and base analog mutagenesis, in addition to spontaneous base pair substitution mutation. It does not, however, markedly affect proflavin mutagenesis. The px mutation maps in the vicinity of genes 41-56, and the hm mutation maps in the vicinity of genes rI-v. (auth)

16762 UNIFORMITY OF NORMALIZED RADIATION-INDUCED MUTATION RATES AMONG DIFFERENT SPECIES. Wolff, S. (Univ. of California, San Francisco); Abrahamson, S.; Bender, M. A.; Conger, A. D. Genetics; 78: No. 1, 133-134(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

A study was made of data for radioinduced forward mutation rates in organisms for which the amounts of DNA per nucleus are known. The normalized mutation rates were all essentially the same for bacteria, fungi, plants, insects, and mammals. The consistency indicates that it is the nucleus, and not the locus, that determines the target size or that the size of a radiation-mutable locus is proportional to the total genome size or DNA content for the species. (HLW)

16763 RADIATION GENETICS IN MICROORGANISMS AND EVOLUTIONARY CONSIDERATIONS. Kondo, S. (Osaka Univ.). Genetics; 78: No. 1, 149-161(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

Recent knowledge of uv-resistance mechanisms in microorganisms is reviewed in perspective, with emphasis on E. coli. Dark-repair genes are classified into "excision" and "tolerance" (ability to produce a normal cope of DNA from damaged DNA). The phenotype of DNA repair is rather common among the microorganisms compared, and yet their molecular mechanisms are not universal. In contrast, DNA photoreactivation is the simplest and the most general among these three repair systems. It is proposed that DNA repair mechanisms evolved in the order: photoreactivation, excision repair, and tolerance repair. The uv protective capacity and light-inducible RNA photoreactivation possessed by some plant viruses are interpreted to be the result of solar uv selection during a rather recent era of evolution. (auth)

16764 INTEGRATION AND REPAIR OF ULTRAVIOLET-IRRADIATED TRANSFORMING DEOXYRIBONUCLEIC ACID IN HAEMOPHILUS INFLUENZAE. Muhammed, A.; Setlow, J. K. (Oak Ridge National Lab., TN). J. Bacteriol.; 118: No. 2, 514-522(May 1974).

The extent of association between donor transforming deoxyribonucleic acid (DNA) and recipient DNA in Haemophilus influenzae as a function of ultraviolet (uv) dose to the transforming DNA has been measured by isopycnic analysis of lysates of ^{3}H-labeled recipient cells exposed to DNA labeled with ^{32}P and heavy isotopes. Except for doses above 15,000 ergs/mm^2, the results of these measurements are in good agreement with previous estimates made by another technique. Experiments with a mutant temperature sensitive for DNA synthesis and another mutant defective in excision of pyrimidine dimers suggest that the discrepancy between the methods of high doses results from DNA synthesis, in which portions of the associated donor DNA containing pyrimidine dimers are excised and broken down, and the components are reutilized for synthesis. Repair of uv-irradiated, transforming DNA during incubation of recipient cells is observed as an increase in transforming ability when fractions from CsCl gradients of cell lysates are assayed on excision-deficient cells. When transforming DNA containing markers of different uv sensitivities is used, repair of the uv-resistant nov marker by excision proficient cells takes place exclusively in the donor DNA that is associated with recipient DNA, and this repair is observed even in the absence of DNA synthesis. However, no repair is observed in the case of the more uv-sensitive str marker, possibly because excision events may remove a large fraction of the integrated str markers in addition to repairing a small fraction of the integrated DNA containing this marker. (auth)

16765 INVOLVEMENT OF recA AND exr GENES IN THE IN VIVO INHIBITION OF THE recBC NUCLEASE. Marsden, H. S.; Pollard, E. C.; Ginoza, W.; Randall, E. P. (Pennsylvania State Univ., University Park). J. Bacteriol.; 118: No. 2, 465-470(May 1974).

When Escherichia coli cells are gamma irradiated they degrade their deoxyribonucleic acid (DNA). The DNA of previously gamma-irradiated T4 phage is also degraded in infected cells. The amount of degradation is not only dependent on the dose but also on the genotype of the cell. The amount of degradation is less in cells carrying a recB or a recC mutation, suggesting that most of the DNA degradation is due to the recB$^+$ and recC$^+$ gene product (exonuclease V). In some strains a previous dose of ultraviolet (uv) light followed by incubation renders the cells resistant to DNA degradation after gamma irradiation. We have shown this inhibition to take place for infecting T4 phage also. By using six strains of E. coli selected for mutations in the genes recA, exr(or lex), and uvrB, we have been able to show that the preliminary uv treatment produces no change in recA and exr cells for both endogenous DNA degradation and the degradation of infecting irradiated T4 phage DNA, i.e., inhibition was not detected in these strains. On the other hand, wild-type cells and strains carrying mutations of uvrB show inhibition in both types of experiments. Because the recA gene product and the exr$^+$ (lex$^+$) gene product are necessary for the induction of prophage, it is possible that the phenomenon of inducible inhibition requires recA$^+$ and exr$^+$ presence. One interpretation of these results is that an inducible inhibitor may be controlled by the exr gene. (auth)

Radiation Effects on Plants

Refer also to abstracts 16762 and 16796.

16766 (AEC-tr-7596, pp 1-7) INFLUENCE OF IONIZING RADIATION ON THE SYNTHESIS OF HISTONES AND TOTAL NUCLEAR PROTEINS IN MERISTEM CELLS OF SPROUTS. Mal'tsev, A. V.; Kuzin, A. M. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 323-327(1974).

In Radiobiology.

The influence of gamma irradiation of seeds of Vicia faba and Trifolium pratense with stimulating and lethal doses on the synthesis of lysine- and arginine-rich fractions of histones and total nuclear proteins in sprouts of various ages was studied. In the case of irradiation at stimulating doses, the synthesis of total nuclear proteins in the meristem cells of the sprouts is increased, whereas the synthesis of total and individual fractions of the histones does not differ from the control. Gamma irradiation of seeds of the investigated plants at lethal doses induces an appreciable inhibition of the synthesis of total nuclear proteins, summary and individual fractions of histones in the sprouts. The dynamics of the synthesis of the lysine- and arginine-rich fractions of the histones varies during different periods of sprout growth. (tr-auth)

16767 (AEC-tr—7596, pp 74-78) INFLUENCE OF THERMAL SHOCK IN THE IRRADIATION OF BARLEY SEEDS WITH RADIATION WITH VARIOUS LINEAR ENERGY LOSSES. Valeva, S. A.; Fedin, P. I. (Inst. of General Genetics, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 378-381(1974).

In Radiobiology.

The influence of pre- and postradiation thermal shock in the irradiation of barley seeds with radiation with various linear ionization densities was investigated. The protective effect of heating to 60°C in the case of irradiation with fast neutrons, more distinct than under the action of gamma radiations, was demonstrated for the first time. The effect of preradiation shock is maintained for several hours. On the basis of the data of cytogenic analysis, an influence of heat treatment on the primary stage of the interaction of radiation with the biological object is suggested. (tr-auth)

16768 (AEC-tr—7596, pp 148-151) INFLUENCE OF IONIZING RADIATION ON CYTODIFFERENTIATION IN A CULTURE OF PLANT TISSUE. Runoa, Yu. N.; Kuzin, A. M.; Kuznetsova, G. P. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 431-434(1974).

In Radiobiology.

The modification of cytodifferentiation by radiation was studied in a culture of plant tissue cultured under strictly controlled conditions. Parenchymal tissue of tobacco plants was used in the study. It was found that the process of natural differentiation is substantially more radiosensitive than the inhibition of tissue growth; and differentiation may be stimulated by irradiation, evidently as a result of the radiation liberation of DNA from the histones, repressing its activity. At high doses (3kR) differentiation is entirely suppressed. (ERB)

16769 (AEC-tr—7596, pp 152-155) MODIFICATION OF RADIATION DAMAGE TO DORMAT SEEDS OF CREPIS CAPILLARIS BY THERMAL SHOCKS AND STORAGE. Atayan, R. R.; Kagramanyan, R. S.; Avakyan, G. M. (Erevan Physical Inst.). 1974. Translated from Radiobiologiya; 14: No. 3, 434-437 (1974).

In Radiobiology.

Dormant seeds are convenient objects for the study of the influence of accompanying factors on radiation damage. The use of temperature as a modifying influence can give important information on the nature of the radiobiological reactions of cells studied. The purpose of this work was to investigate the influence of thermal shock (preradiation, postradiation, and twice) on radiation damage to the chromosomes and the change in the yield of chromosome aberrations in the process of postradiation storage, depending on one temperature influence or another, and also to follow the possible change in the effects of thermal shocks with time. (tr-auth)

16770 (AEC-tr—7596, pp 176-180) ACTIVITY OF THE INCORPORATION OF RADIOACTIVE PHOSPHATE IN GAMMA AND ELECTRON IRRADIATION OF POTATO TUBERS. Serebrenikov, V. S. 1974. Translated from Radiobiologiya; 14: No. 3, 450-453(1974).

In Radiobiology.

The incorporation of labelled phosphate into various fractions of phosphorus-containing substances after γ and electron irradiation of potato tubers was studied. The radiations induced appreciable changes in the penetrating ^{32}P-labelled phosphate into the tubes. This increased activity was correlated with growth processes in the tubers. The doses of radiation used had the greatest stimulating effect on the sprouting of the tubers, the apperance of sprouts, and their weight. (ERB)

16771 (AEC-tr—7596, pp 181-184) SOME PHYSIOLOGICAL PECULIARITIES OF RADIORESISTANT PLANTS. Berezina, N. M.; Vagabova, M. E. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 453-456(1974).

In Radiobiology.

At the present time, an increasing number of facts indicate that the radioresistance of organisms is due to many peculiarities, manifested both at the moment of irradiation and in the subsequent period of formation of radiation damage. It was established that in dormant seeds of all highly resistant plants there are endogenous radioprotectors, specific for different species of this group of plants, in the form of allylmustard oils, cyanides, and unsaturated fatty acids. A direct correlation was established between the content of these substances and radioresistance, confirming the protective role of protectors present in the seeds at the moment of irradiation, through the interception of free radicals. Then, simultaneously with the awakening of the dormant seeds, a chain of physiological processes begins in them, determining the energy balance of the germinating seeds, respiration, photosynthesis, oxidative phosphorylation, a higher level of which may promote an intensification of recovery processes. This work cites the results of a comparative determination of the respiration rate of a number of highly resistant and radiosensitive plants. A correlation between radiosensitivity and respiration rate was established. (ERB)

16772 (AEC-tr—7596, pp 185-187) INFLUENCE OF X RAYS ON THE ULTRAWEAK CHEMILUMINESCENCE OF THE MITOCHONDRIA OF KIDNEY BEAN PLANTS. Gorlanov, N. A.; Churmasov, A. V. (Gorkiy State Univ., USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 457-459(1974).

In Radiobiology.

The mitochondria play an exceptionally important role in the energy metabolism of cells. It is known that they are extremely radiosensitive systems of the living cell. Under the action of radiation, both the functional activity of the mitochondria and their structure are disrupted and oxidative phosphorlation is inhibited. It has been shown that under the optimum conditions for oxidative phosphorylation, mitochondria isolated from the tissues of animals emit light quanta in the visible region of the spectrum; this is associated with the participation of free radicals and excited electronic states in this process. Comparing the facts of high sensitivity of the motochondria to radiation and the presence of ultraweak luminescence, which has not been studied on plant objects, we undertook to investigate the ultraweak chemiluminescence (UCL) of the mitochondria in connection with irradiation of the plants with ionizing radiation. It seems that a measurement of the UCL may be considered as a method that will permit recording of damage to the mitochondria by radiation and will aid in the disclosure of certain mechanisms of its action. (tr-auth)

16773 (BNL-19320) EFFECTS OF CHEMICAL MUTAGENS (EMS, DBE) AND SPECIFIC AIR POLLUTANTS (O_3, SO_2, NO_2, N_2O) ON SOMATIC MUTATION RATES IN TRADESCANTIA. Sparrow, A. H.; Schairer, L. A. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 40p. (CONF-740244-1). Dep. NTIS $5.00.

From potential genetic effects on environmental pollutants on man; Moscow, USSR (18 Feb 1974).

The somatic mutation responses of two different blue-flowering clones of Tradescantia (clones 02 and 4430) heterozygous for flower color may be used advantageously as a monitor or test system for induced genetic injury. Studies have been made comparing the mutagenic effects of x rays, chemical mutagens and suspected mutagens, such as certain air pollutants and insecticides, with each other and against the control (untreated) rate. Significant increases in mutation rate after an acute exposure as low as 250 mrads of x rays, 33 mR/hr of chronic gamma exposure from ^{137}Cs, and 6 hr of treatment with <10 ppM of gaseous ethyl methanesulfonate (EMS), 1,2-dibromoethane (DBE) or 50 ppM of SO_2 attest to the efficacy of the Tradescantia stamen hair system as an indicator of genetic injury. Significant increases in mutation rate above control levels have been observed for ozone, SO_2, and N_2O and for one pesticide, but the data suggest that they are at best weak mutagens in this system since the maximum response obtained was little more than twice the control rate. From data to be presented on pink somatic mutation rates the relative effectiveness of the various mutagens tested can be estimated and is presumably indicative of their probable hazard to man. (auth)

16774 SEGREGATION AND RECOMBINATION OF NON-MENDELIAN GENES IN CHLAMYDOMONAS. Gillham, N. W.; Boynton, J. E.; Lee, R. W. (Duke Univ., Durham, NC). Genetics; 78: No. 1, 439-457(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

Non-Mendelian genes in Chlamydomonas reinhardtii are inherited in a uniparental (UP) fashion. Most zygotes and their progeny receive UP genes only from the mt^+ or maternal parent. However, a few exceptional zygotes are also found in which the mt^- or paternal UP genome is transmitted. Most of the exceptional zygotes are biparental in that their progeny segregate UP genes transmitted by both parents. As a result, biparental zygotes have been extensively used to study the rules governing UP inheritance. The frequency of biparental zygotes can be greatly increased if the maternal parent is irradiated with ultraviolet light prior to mating. Based principally on studies with ultraviolet induced biparental zygotes, Sager has argued that a vegetative cell contains two copies of the UP genome and that the progeny of a biparental zygote receive a copy derived from each parent. Results reported in this paper with spontaneous and ultraviolet-induced biparental zygotes do not support the two copy model, but argue for a multiple copy model with most of the copies normally being transmitted by the maternal parent. A multiple copy model which accounts for both Sager's results and ours is presented. (auth)

16775 EFFECT OF X-IRRADIATION ON THE SIZE OF THE MUTATED SECTOR IN DIPLOID AND TETRAPLOID RICE. Sree Rangasamy, S. R.; Sree Ramulu, K. (Tamilnadu Agricultural Univ., Coimbatore (India). Dept. of Biology). Theor. Appl. Genet.; 44: No. 6, 266-269(1974).
5 tabs.; 19 refs.

An investigation was carried out of the effects of x-irradiation on the size of the mutated sector in three diploids (A.S.D.8, T.N.1, and G.E.B.24) and the autotetraploid of G.E.B.24 of Oryza sativa L., by analyzing the M_2 segregation ratios of chlorophyll mutants. A total of 612 segregating M_1 panicle progenies in the diploids and 284 panicle progenies in the tetraploid was studied in the M_2 generation for the ratio of normal to chlorophyll mutant seedlings. Of the 573 segregating M_1 panicles analyzed by chi square test in the diploids, 206 showed good fit with a 3 : 1 ratio, while the rest of the progenies (367) deviated significantly in both directions from the expected 3 : 1 segregation. This was interpreted as the result of M_1 panicles developing from both single cell and multicellular initials following x-irradiation, the former 3 : 1. An assessment of fertility (as judged from the number of M_2 seedlings per mutated M_1 panicle), related to the distribution of chi square deviations from the 3 : 1 ratio in the diploids, indicated that the M_1 panicle progenies deriving from single cell initials had low fertility but those originating from multicellular initials ranged from low to high fertility. A comparison of the distribution pattern of the M_2 segregation ratios of chlorophyll mutant phenotypes in the diploid and autotetraploid G.E.B.24 indicated that, in the tetraploid, a larger sector and only one, or fewer cell initials than in the diploid species, are involved. (auth)

Radiation Effects on Animals

Man

Refer also to abstracts 16614, 17766, and 19112.

16776 (ABCC-TR-0-73) BIBLIOGRAPHY OF PUBLISHED PAPERS OF THE ATOMIC BOMB CASUALTY COMMISSION. (Atomic Bomb Casualty Commission, Hiroshima (Japan); Atomic Bomb Casualty Commission, Nagasaki (Japan)). 1973. 8p. Dep. NTIS $4.00.

A list is presented of 150 publications during 1973 that report results of investigations of the health status of persons exposed to radiations from the atomic bomb explosions at Hiroshima and Nagasaki, and their progeny. (CH)

16777 (AEC-tr-7595) BLASTOMOGENIC ACTION OF IONIZING RADIATION. Strel'tsova, V. N.; Moskalev, Yu. I. Dec 1974. Translation of Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964. 412p. Dep. NTIS $10.60.

Seperate abstracts were prepared for each of the 13 chapters. (MCG)

For abstracts of individual chapters see: 16778–16782, 16790–16795, 16834, and 16835.

16778 (AEC-tr-7595, pp 11-75) MECHANISMS OF THE APPEARANCE AND DEVELOPMENT OF OSTEOSARCOMAS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

A literature review of the following topics is given: clinical observations of bone tumors following therapeutic external irradiation and of osteosarcomas developing in man upon internal irradiation by natural radioisotopes of radium and thorium; experimental investigations of osteosarcomas induced in animals by natural radioisotopes of radium and thorium and by artificial radioisotopes such as ^{89}Sr, ^{90}Sr, ^{140}Ba, ^{90}Y, ^{91}Y, ^{144}Ce, ^{147}Pm, ^{137}Cs, ^{106}Ru, and ^{239}Pu; the role of physical factors in the occurrence of osteosarcomas; the significance of physiological factors in the development of bone tumors; the latent period of osteosarcomas; the localization of osteosarcomas; the multicentricity of osteosarcomas of isotopic etiology; the metastatic spreading of osteosarcomas; pretumorous changes in bones; and the structure of tumors. (HLW)

16779 (AEC-tr-7595, pp 76-131) DEVELOPMENT OF LEUKOSES UPON EXPOSURE TO IONIZING RADIATION. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

A review of studies on clinical aspects of leukosis includes the following: frequency of leukosis in people exposed to diagnostic x-ray examinations in Denmark; latent period of acute and chronic forms developing after x-ray therapy; leukoses in medical personnel; incidence of leukemia among irradiated population of Hiroshima and Nagasaki; leukemogenic effectiveness of fractionated irradiation; cytological types of leukoses in patients with ankylosing spondylitis; and leukemia in man following use of ^{131}I or ^{32}P for therapy. A review of experimental investigations of leukoses includes the following: x-ray-induced leukemia in mice; induction of leukemia in rats by ^{90}Sr, ^{89}Sr, ^{32}P, ^{239}Pu, and ^{144}Ce; radioinduced leukoses in rats in relation to dose-effect curve, dose rate, and irradiation schedule of chronic irradiation; relation of incidence of leukoses in rats to tissue distribution of radioisotopes; the path of entry of radioisotopes and incidence of leukosis; significance of physiological factors; types of leukoses; changes in hematopoiesis preceding appearance of leukoses; and pathogenesis of leukoses. (HLW)

16780 (AEC-tr-7595, pp 183-200) TUMORS OF THE SKIN AND ITS APPENDAGES. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

Data from the literature are presented on the following: occupational cancer of skin of the hands of radiologists; radioinduced skin cancer in patients following x-ray therapy; pathological changes in skin preceding appearance of the tumor; experimental production of skin tumors in rabbits, mice, and chickens by x and gamma radiation; blastomogenic effects of ^{90}Sr following subcutaneous administration in the form of glass beads; induction of skin tumors in mice by thorium dioxide; skin tumors in rats following administration of ^{144}Ce, ^{95}Nb, and ^{106}Ru; blastomogenic effects of beta particles on skin; skin tumors in mice induced by ^{32}P and methylcholanthrene; and carcinogenic effects of croton oil, tobacco resins, and benzpyrene. (HLW)

16781 (AEC-tr-7595, pp 245-258) TUMORS OF THE GENITAL ORGANS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

Tumors of the ovaries and uterus arising as a complication of radiotherapy are reviewed. Studies are reviewed on ovarian tumors of mice following a single dose of neutrons, x radiation, or gamma radiation. Experiments on rats showed that ovarian tumors occurred in 4% of animals exposed to ^{144}Ce and ^{90}Sr. The pathogenesis of radioinduced ovarian tumors is discussed. Studies on uterine tumors in rabbits exposed to daily gamma radiation throughout life are reviewed. Experiments on development of tumors of the male genital organs in rats exposed to ^{239}Pu and protons, dogs exposed to ^{210}Po, and mice exposed to gamma radiation are reviewed. (HLW)

16782 (AEC-tr-7595, pp 277-320) GENERAL MECHANISMS OF TUMORIGENESIS INDUCED BY IONIZING RADIATION. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

The following topics are discussed: correlation between the localization of irradiation and the site where neoplasms appear; the significance of the time factor; dose-effect relationships and the threshold problem; peculiarities of the blastomogenic effect of different types of radiation; the role of physiological factors in radiation carcinogenesis; and the effect of prophylactic and therapeutic agents on radiation carcinogenesis. (HLW)

16783 (AED-CONF-73-546-008) RADIATION PROTECTION IN X-RAY RADIOGRAPHY. Ullrich, H. (Siemens A. G., Erlangen (F. R. Germany). Unternehmensbereich Medizinische Technik). 1973. 16p. (In German). INIS.

From 14th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte e. V.; Wuerzburg, F. R. Germany (16 Nov 1973).

11 figs.; 11 refs.

The x-ray apparatus and units produced by the German manufacturers comply with the requirements set by the X-Ray Ordinance as they have been built in accordance with the criteria established by the radiation protection standards. In special cases, the standards to be applied have to be interpreted in some way or other since it is impossible to account for all types and variants of x-ray units in these standards. In such cases, accompanying equipment specifications have to be written in such detail that the user as well as the testing and supervisory authorities will easily recognize the underlying standard criteria and the measures taken by the manufacturer in order to keep the radiation dose to user and personnel within the limits stipulated by the appropriate legislation. (GE)

16784 (IAEA-R-957-F) DEOXYCYTIDINE AND PSEUDOURIDINE LEVELS IN URINE AND PLASMA AS AN INDEX OF IONIZING RADIATION DOSE. Final Report, 1 December 1970–30 November 1973. Chapman, I. V. (International Atomic Energy Agency, Vienna (Austria)). Jan 1974. 14p. INIS.

A biochemical indicator of radiation injury can be used in conjunction with physical dosimetry as an aid in assessing the efficiency of radiotherapy treatment and in determining the severity of injury in cases of accidental exposure to ionizing radiation. Physical dosimetry alone is inadequate in indicating the distribution and biological significance in absorbed dose. Interruption of nucleic acid metabolism is one of the modes of action of ionizing radiation thought to be associated with the death of the cell. The concentration of nucleic acid metabolites excreted by the individual may vary from normal following exposure to radiation. The investigations described here involved an assessment of DNA precursor, deoxycytidine (CdR) and t-RNA precursor, pseudouridine (ψU) in the urine of rats, mice and humans following partial- or whole-body exposure to x radiation. The object of the work involved a survey of the possible usefulness of either of these substances as biological indicators of radiation damage. (INIS)

16785 DENTAL X-RAY PROTECTION. Johnson, F. S. J. Calif. Dent. Ass.; 2: 73-75(1974).

The use of maximum permissible dose equivalent values and other measures for protection of dental workers are discussed. The importance of reducing exposure from special x-ray installations such as multiple tubes and scattered radiation from diaphragms is pointed out. Parameters to be considered in structural shielding design are workload, use factor, and occupancy factors. A list of operating procedures to be observed by dental personnel during exposure of patients is presented. (HLW)

16786 HEAVY COSMIC-RAY EXPOSURE OF APOLLO ASTRONAUTS. Benton, E. V. (Univ. of San Francisco); Henke, R. P.; Bailey, J. V. Science; 187: No. 4173, 263-265(24 Jan 1975).

A comprehensive study of the heavy-particle cosmic-ray exposure received by the individual astronauts during the nine lunar Apollo missions reveals a significant variation in the exposure as a function of shielding and the phase of the solar cycle. The data are useful in planning for future long-range missions and in estimating the expected biological damage. (auth)

16787 TOTAL BODY IRRADIATION (TBI) AS PRIMARY THERAPY FOR ADVANCED LYMPHOSARCOMA. Johnson, R. E. (National Cancer Inst., Bethesda, MD). Cancer; 35: No. 1, 242-246(Jan 1975).

The natural history of lymphocytic lymphomas is such that diffuse involvement usually is present at diagnosis. Extensive lymphatic irradiation with tumoricidal doses is seldom an appropriate form of treatment, as most patients require systemic therapy. We have investigated total body irradiation (TBI) as an alternative to chemotherapy. A series of 39 consecutive untreated patients with generalized disease is reviewed. Actuarial 5-year survival rates for the well-differentiated, poorly differentiated nodular, and poorly differentiated diffuse histologic types are 100%, 78%, and 56% respectively. The single major complication, acute myelocytic leukemia, has developed in 2 of the 8 patients given extensive nodal irradiation as a supplement to TBI. None of the 31 patients receiving only TBI as initial therapy has shown evidence of a myeloproliferative disorder to date. (auth)

16788 STRAHLENEMPFINDLICHKEIT VON ORGANEN UND ORGANSYSTEMEN DER SAEUGETIERE UND DES MENSCHEN. Symposia Veranstaltet von der Arbeitsgemeinschaft fuer Strahlenbiologie in der DRG und der Vereinigung Deutscher Strahlenschutzaerzte e.V. am 11. Mai 1972 in Stuttgart und am 23. Sep in Freiburg i.Br. (Radiosensitivity of Organs and Organ Systems of Mammals and of Man. Symposia Sponsored by the Arbeitsgemeinschaft fuer Strahlenbiologie of the DRG and the Vereinigung Deutscher Strahlenschutzaerzte e.V., Stuttgart, May 11th, 1972 and Freiburg i.Br., Sep 23rd, 1972). Braun, H.; Heuck, F.; Ladner, H. A.; Messerschmidt, O.; Musshoff, K.; Streffer, C. Strahlenschutz in Forschung und Praxis. Stuttgart, F.R. Germany; Thieme (1973). 205p. (In German). (ISBN-3134513013).

From German roentgen congress; Stuttgart, F.R. Germany (11 May 1972).

66 figs.; 23 tabs.; with refs.

The present volume contains lectures given at two different symposia, providing a review of the present state of knowledge on the radiation sensitivity of the most important organs and organ systems such as the lymphatic system, bone marrow, lungs, liver, kidney, gonads, blood vessels, connective tissue, skeleton, and nervous system. One of the aims pursued was to relate clinical results and experience with experimental findings on mammals, and to find out to what extent results of animal experiments can be applied to other cases. The radiobiological experiments reported were mainly concerned with studying late effects, their dose response relationships, occurrence in terms of time, and possible treatment. Some introductory remarks about the radiobiology of cells are given, which considerably contributes to a better insight into the radiation effects on organs as a whole. Furthermore, problems relating to the radiation sensitivity of the embryogenesis and the genetic risk as a result of irradiation with ionizing radiations are discussed. (GE)

16789 EVIDENCE IN MAN OF RADIATION CARCINOGENESIS OF THE THYROID. Dolphin, G. W. (National Radiological Protection Board, Harwell, Eng.). Proc. Roy. Soc. Med.; 67: No. 11, 1103-1104(Nov 1974).

The considerable body of published evidence for the increased risk of thyroid cancer following irradiation of the thyroid, particularly in young people, is surveyed. Most of the evidence came from persons who had received external radiation and consequently other organs, such as the thymus, may have been irradiated simultaneously, with a possible influence on the onset of thyroid cancer. The risk of thyroid cancer following administration of ^{131}I for diagnosis or treatment could not be evaluated from the available published data; the interpretation of future follow-up surveys of such patients may give distorted results, as the patients were originally selected for thyroid malfunction. (U.K.)

Vertebrates

Refer also to abstracts 16358, 19119, 19158, and 19161.

16790 (AEC-tr-7595, pp 159-163) TUMORS OF THE KIDNEYS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

A review of the literature on kidney tumors includes discussions of kidney tumors induced in man by exposure to polonium and Thorotrast; renal neoplasms in mice induced by gamma and neutron irradiation; and renal tumors in rats induced by x radiation and neutrons. Experiments with radioisotopes showed that nephromas occurred more often following exposure to ^{137}Cs and ^{106}Ru than to ^{144}Ce. The histology and morphology of the different types of tumors are described. (HLW)

16791 (AEC-tr-7595, pp 164-182) TUMORS OF THE GASTROINTESTINAL TRACT. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

A literature report is given of salivary gland tumors developing in rats after exposure to various doses of x rays. Data from the literature are also presented on incidence of stomach cancer in atomic bomb survivors of Hiroshima, stomach tumors of rats and mice following exposure to neutrons and x radiation, and effects of spleen extract and EDTA on tumor incidence in mice exposed to ^{95}Nb. Data from the literature on intestinal tumors include reports on the incidence of intestinal tumors in rats exposed to x rays, high-energy neutrons, protons, ^{144}Ce, ^{95}Nb, ^{137}Cs, and ^{106}Ru. The histology and morphology of various types of tumors are described. It was concluded that the incidence of gastrointestinal neoplasms increased as the radiation dose increased. Chronic inflammation played a cocarcinogenic role in the development of intestinal neoplasms. (HLW)

16792 (AEC-tr-7595, pp 201-244) TUMORS OF THE ENDOCRINE GLANDS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

Data from the literature are reviewed on tumors of the hypophysis with regard to clinical observations and experimental production of tumors. In some cases radioactive substances were detected in patients with tumors of the hypophysis. Tables are presented to show incidence of hypophyseal tumors in animals as a function of dose of neutrons, x radiation, and gamma radiation. Tables are also presented to show incidence of hypophyseal adenomas in rats exposed to ^{90}Sr, ^{144}Ce, ^{147}Ce, ^{147}Pm, ^{106}Ru, and ^{95}Nb. Thyroid tumors are reviewed with regard to clinical observations and experimental production. Data on incidence of thyroid tumors in children treated for goiter with x rays are tabulated. Data are also reported on thyroid tumors in rats and mice exposed to x and gamma radiation and in rats exposed to ^{131}I, ^{90}Sr, ^{144}Ce, and ^{147}Pm. Studies on tumors of the parathyroid glands, adrenal glands, and pancreas are presented. The mechanism of the development of radioinduced endocrine tumors is discussed. (HLW)

16793 (AEC-tr-7595, pp 259-273) MAMMARY TUMORS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

A review of studies on mammary tumors includes the following: radioinduced fibrosarcomas in rats and carcinomas in mice; effects of daily x irradiation of mice on frequency of mammary cancer; effects of neutron irradiation on incidence of mammary tumors; relation between radiation dose and incidence of tumors; blastomogenic effects of ^{185}W, ^{103}Ru, ^{35}S, ^{89}Sr, ^{45}Ca, ^{65}Zn, ^{204}Tl, ^{110}Ag, ^{90}Sr, ^{144}Ce, ^{147}Pm, and ^{95}Nb; effects of estrogens and other hormones on radioinduced mammary tumors; and effects of ovariectomy on incidence of radioinduced mammary tumors. (HLW)

16794 (AEC-tr-7595, pp 274-276) TUMORS OF OTHER TISSUES AND ORGANS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

Data from the literature are presented on the following: tumors of accessory cranial sinuses in patients treated with radium and thorium; ^{90}Sr-induced malignant neoplasms of glands of the eye-socket; tumors of lymph nodes induced by Thorotrast in man and by ^{90}Y in mice; cancer of the tongue following use of ionizing radiation and radium needles for therapy; tongue cancer induced by radioactive silver; and tumors of muscular tissue of rats induced by ^{110}Ag. (HLW)

16795 (AEC-tr-7595, pp 321-335) SOME QUESTIONS RELATING TO THE PATHOGENESIS OF RADIATION-INDUCED TUMORS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

The following topics are discussed: the role of somatic mutations and chromosomal aberrations in the appearance of tumor cells; the role of respiratory-enzyme damage in the formation of tumor cells; and the condition of the organism and tumorigenesis. (HLW)

16796 (AEC-tr-7596) RADIOBIOLOGY. Translated from Radiobiologiya; 14: No. 3, 323-472(1974). 207p. Dep. NTIS $7.60.

Separate abstracts were prepared for the 39 papers contained in this issue. (ERB)

For abstracts of individual papers see: 16538, 16747, 16755–16759, 16766–16772, 16797–16820, and 16845.

16797 (AEC-tr-7596, pp 8-12) DNA-DEPENDENT RNA POLYMERASE OF THE ORGANS OF IRRADIATED ANIMALS. Communication 1. Nucleolar RNA Polymerase (form A) from Liver and Spleen Nuclei of White Rats. Paskevich, I. F.; Ishkhanova, M. A.; Stolyarov, I. V.; Likhoded, V. S. (Kharkov Scientific Research Inst. of Medical Radiology). 1974. Translated from Radiobiologiya; 14: No. 3, 328-331(1974).

In Radiobiology.

The activities of nucleolar RNA polymerase AI and AII, isolated from the livers and spleens of irradiated rats (48 hrs, 800 R), were investigated. It was shown that the level of RNA synthesis of DNA isolated after irradiation at doses of 400 R (24 to 120 hrs) and 800 R (24 to 48 hrs) remains practically unchanged for both classes of RNA polymerases, whereas after 120 hrs (dose 800 R), the level of RNA synthesis is sharply inhibited in comparison with the control. (tr-auth)

16798 (AEC-tr-7596, pp 13-18) DEOXYNUCLEOSIDURIA IN RATS AFTER REPEATED IRRADIATION UNDER CONDITIONS OF A SINGLE ADMINISTRATION OF HETEROLOGOUS DNA. Mazurik, V. K.; Moskaleva, E. Yu.; Fedorova, T. A. (Inst. of Biophysics, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 332-336(1974).

In Radiobiology.

The dependence of the excretion of deoxynucleosides in response to repeated irradiation on the time between the first and second influences showed three phases and reflected the course of the impairment and restoration of the content and metabolism of DNA in the hematogenic organs of irradiated rats. In the case of intervals between influences of 1 to 13 weeks, ~3 weeks, and 28 to 30 days, correspondingly less of the deoxyribosides were isolated, adequate to the dose, or two to three times as great as after a single irradiation. Exogenous DNA had an influence on the degree of expression of this pattern. (tr-auth)

16799 (AEC-tr-7596, pp 19-25) AUTOIMMUNE REACTIONS AND ENDOGENOUS INFECTION IN RATS AFTER WHOLE-BODY EXTERNAL BETA IRRADIATION. Shal'nova, G. A.; Smirnov, A. V. 1974. Translated from Radiobiologiya; 14: No. 3, 337-341 (1974).

In Radiobiology.

As a result of whole-body external beta irradiation at doses of 2,500, 4,500, and 6,500 rad (from a strontium-90–yttrium-90 source, dose rate 145 rad/min), autoimmune reactions develop in rats of the August line (the appearance of antitissue autoantibodies in the blood and autoantibody-forming cells in the blood and internal organs), which is accompanied by a decrease in the autoinfectious resistance and the development of endogenous infection. (tr-auth)

16800 (AEC-tr-7596, pp 26-32) POSTRADIATION PECULIARITIES OF THE CALCIUM METABOLISM IN THE TISSUES OF RATS AND THEIR RELATIONSHIP TO THE STATE OF THE SODIUM AND PHOSPHATE METABOLISM. Grozdov, S. P. (Inst. of Biophysics, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 342-347(1974).

In Radiobiology.

Irradiation at a dose of 900 R induces the accumulation of calcium in radiosensitive tissues, together with a loss of potassium and an increase in sodium. The incorporation of ^{45}Ca into the tissues of the thymus, bone marrow, spleen, etc., is already substantially intensified 1 to 1.5 hrs after irradiation, outstripping the accumulation of ^{22}Na. An investigation of the microstructures of the thymus showed that the accumulation of Ca in the first hours after irradiation occurs exclusively in the mitochondria. The changes in the indices of phosphate metabolism are evidence that the accumulation of Ca in the mitochondria occurs against a background of inhibition of the bioenergetics and is not accompanied by an accumulation of phosphate. Evidently, postradiation damages to the mitochondrial structures and the appearance of lipid factors, which bind calcium, play a role in the mechanism of this phenomenon. (tr-auth)

16801 (AEC-tr-7596, pp 33-39) CHANGES IN THE LYMPHOID TISSUE AFTER THE INTRODUCTION OF BACTERIAL POLYSACCHARIDE INTO INTACT AND IRRADIATED ANIMALS. Gordeeva, M. S.; Duplishcheva, A. P.; Tumanyan, M. A. (Inst. of Epidemiology and Microbiology, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 348-352(1974).

In Radiobiology.

The action of polysaccharide from typhoid fever bacteria on the lymphoid tissue (thymus, spleen, lymph nodes) of mice of the CBA line and F_1 hybrids was studied. It was shown that the polysaccharide has an influence of lymphopoiesis, stimulating processes of proliferation and differentiation of the cells of the lymphoid tissue. In a comparison of the regeneration of the lymphoid tissue in irradiated unprotected and polysaccharide-protected animals, no significant differences in the rate of recovery processes were detected. However, among the animals that received polysaccharide before irradiation, the weight was significantly higher than in unprotected animals. (tr-auth)

16802 (AEC-tr-7596, pp 40-44) ROLE OF ENDOGENOUS SUBSTANCES IN THE CREATION OF A BACKGROUND OF INCREASED RADIORESISTANCE. Communication 6. Study of the Influence of Serotonin on the Process of Formation of Oxidation Products of Lipids in the Microsomes of the Mucosa of the Small Intestine. Sobolev, A. S.; Zhamsaranova, S. D.; Goncharenko, E. N.; Kudryashov, Yu. B. (Moscow State Univ.). 1974. Translated from Radiobiologiya; 14: No. 3, 353-355(1974).

In Radiobiology.

The presence of processes of peroxide oxidation of unsaturated fatty acids in the microsomes of the mucosa of the small intestine was demonstrated. The introduction of serotonin into the incubation mixture leads to a decrease in the level of oxidation products of lipids, which are endogenous radiosensitizers. On the basis of the data obtained, cited in the article and published earlier, it is suggested that serotonin can normally influence the level of endogenous lipid radiosensitizers. The possible mechanisms of the radioprotective action of serotonin are discussed. (tr-auth)

16803 (AEC-tr-7596, pp 45-48) RADIOPROTECTIVE ACTION OF EXOGENOUS INTERFERON. Khaytovich, A. G.; L'vovskii, E. A.; Kiselev, P. N. (Central Scientific Research Roentgenoradiological Inst., Leningrad). 1974. Translated from Radiobiologiya; 14: No. 3, 356-358(1974).

In Radiobiology.

The maximum survival of mice was observed after the administration of homologous interferon 24 hrs before irradiation at doses of 600 and 750 rad. The radioprotective activity of heterologous (rabbit) interferon is 3.3 times lower. The partial inactivation of interferon after heating at 56°C for 30 min leads to a decrease in its radioprotective action. The possibility of the participation of viruses activated in the irradiated organism in the pathogenesis of radiation sickness is discussed. (tr-auth)

16804 (AEC-tr-7596, pp 49-53) QUESTION OF CHEMICAL PROTECTION IN THE CASE OF NEUTRON IRRADIATION OF

ANIMALS. Sverdlov, A. G.; Bogatyrev, A. V.; Nikanorova, N. G.; Timoshenko, S. I.; Krasotskaya, G. I. (Leningrad Inst. of Nuclear Physics). 1974. Translated from Radiobiologiya; 14: No. 3, 359-362(1974).
In Radiobiology.

The radioprotective effectiveness of S-2-(omega-aminopropylaminoethyl) phosphorothioate (gammaphos) in the case of neutron irradiation of mice was investigated. It was established that gammaphos possesses pronounced protective properties (survival in the experiment 56.7%, in the control 14.5%). The combination of gammaphos with the creation of conditions of repopulation of the hematogenic tissue is a promising method for increasing the survival in the case of neutron irradiation. (tr-auth)

16805 (AEC-tr-7596, pp 54-57) DEPENDENCE OF THE MORTALITY AND CLINICAL SYMPTOMS OF RADIATION SICKNESS IN DOGS AND RATS ON THE DOSE OF IRRADIATION WITH FAST NEUTRONS OR GAMMA QUANTA OF ^{60}Co. Shaporov, V. N.; Khar'kov, Yu. I. (Inst. of Biochemistry, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 363-365(1974).
In Radiobiology.

The quantitative dependences of the mortality and clinic of radiation sickness on the dose of gamma radiation and neutrons were studied. K_{RBE} in the irradiation of dogs and rats at a dose of $LD_{50/30}$ is 1.8 and 2.8, respectively. The possibility of using the method of quantitative evaluation of the clinical symptoms in small laboratory animals was demonstrated. K_{RBE} according to this criterion is equal to 2.5 for dogs and 2.0 for rats. (tr-auth)

16806 (AEC-tr-7596, pp 89-94) BONE MARROW HEMATOGENESIS IN RHESUS MONKEYS IN THE CASE OF CHRONIC IRRADIATION. Dzhikidze, E. K.; Kuksova, M. I.; Kosichenko, L. P. (Inst. of Experimental Pathology and Therapy, Sukhumi, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 390-394(1974).
In Radiobiology.

The dynamics of bone marrow hematogenesis was studied on adult rhesus monkeys, irradiated at 4.9 to 4.35 R/day and at 1.37 to 0.8 R/day, with a consideration of the summary dose of radiation. The observed changes depend on the individual peculiarities of the organism. (tr-auth)

16807 (AEC-tr-7596, pp 95-98) INVESTIGATION OF THE EFFECTS OF IONIZING RADIATION ON DNA BIOSYNTHESIS IN ISOLATED MITOCHONDRIA OF THE INTACT AND REGENERATING RAT LIVER. Khanson, K. P. (Central Roentgenoradiological Scientific Research Inst., Leningrad). 1974. Translated from Radiobiologiya; 14: No. 3, 395-397(1974).
In Radiobiology.

The goal of this work encompassed a comparison of the nature of the influence of x radiation and inhibitors of respiration and oxidative phosphorylation on DNA synthesis in isolated rat liver mitochondria. In the presence of all the components of the reaction mixture (complete systems), a maximum intensity of the incorporation of the label into mtDNA is observed. The addition of DNAase to the medium has a negligible effect on the synthesis of mtDNA, which, however, decreases when the oxidation substrate (succinate) is excluded. The latter effect is especially sharply manifested in the absence of exogenous ATP. In the presence of an inhibitor of electron transport, cyanide (1×10^{-3} M), a more pronounced inhibition of mtDNA synthesis is observed than under the influence of an uncoupler of oxidative phosphorylation, 2,4-dinitrophenol (5×10^{-5} M). The ability of mitochondria isolated from the livers of irradiated animals to synthesize DNA was compared with the control, both in the complete system and in a medium without added ATP. The synthesis of DNA in the mitochondria of the intact liver is significantly reduced 24 hrs after irradiation at a dose of 800 rad. In a medium without ATP, the differences between the control samples and those containing irradiated mitochondria are less pronounced. The stimulation of liver cells to division after partial hepatectomy is sharply activated by the process of synthesis of mtDNA. Irradiation of the animals 6 hrs after the operation (G_1 phase of the mitotic cycle), inhibits DNA synthesis in the mitochondria. However, the incorporation of ^{14}C-thymidine remains at a level exceeding that in the mitochondria of the intact liver. (ERB)

16808 (AEC-tr-7596, pp 99-103) CHANGES IN THE NUCLEOTIDE COMPOSITION OF THE NUCLEAR DNA OF THE REGENERATING RAT LIVER IN THE CASE OF WHOLE-BODY X IRRADIATION. Komar, V. E.; Tkachenko, T. G. (Central Roentgenoradiological Scientific Research Inst., Leningrad). 1974. Translated from Radiobiologiya; 14: No. 3, 398-401(1974).
In Radiobiology.

The nucleotide composition of the nuclear DNA was investigated in the case of irradiation in the G_1 and S phases of the cell cycle of hepatocytes of the regenerating rat liver. The results obtained give evidence of the greater radiosensitivity of the primary structure of DNA in the synthetic phase of the cell cycle and a change in the nature of DNA synthesis during the postradiation period. (ERB)

16809 (AEC-tr-7596, pp 107-110) INVESTIGATION OF THE ULTRAVIOLET FLUORESCENCE OF CHICK EMBRYO LIVER MITOCHONDRIA UNDER THE ACTION OF PENETRATING RADIATION AND THYROXIN. Khakimov, P. A.; Yangibaev, M.; L'vovich, N. A.; Khamidov, D. Kh. (Inst. of Biochemistry, Tashkent, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 403-406(1974).
In Radiobiology.

The intensity of the ultraviolet (uv) fluorescence of cells varies during the process of differentiation, in the presence of a change in the functional state and radiation damage. It has been established that the mitochondria fluoresce more intensively than other cell structures, and the functional state of the cell can be judged according to the change in the intensity and spectrum of the uv fluorescence. In view of this, the influence of the hormone of the thyroid gland, thyroxin, and ionizing radiation on the fluorescence characteristics of isolated liver mitochondria during the process of embryonic development was investigated. (tr-auth)

16810 (AEC-tr-7596, pp 111-114) PARTICIPATION OF LONG- AND SHORT-LIVED LYMPHOCYTES IN THE RESTORATION OF THE CELL COMPOSITION OF THE CORTEX OF THE LYMPH NODES AFTER IRRADIATION. Pozharisskaya, T. D.; Dunaevskaya, L. I. (Military Medical Academy, Leningrad). 1974. Translated from Radiobiologiya; 14: No. 3, 406-409(1974).
In Radiobiology.

The population of small lymphocytes of the lymph nodes consists of long- and short-lived cells, which also differ in their functions. However, until now it has been unclear whether both types of small lymphocytes participate in circulation, and it has been unknown whether the long- or short-lived lymphocytes increase their number in the cortex of the irradiated lymph nodes during the first day after partial irradiation of the body. The elucidation of these questions is the purpose of this present work. One day after whole-body irradiation, a pronounced devastation of the cortex of the lymph nodes was observed: the centers of reproduction were not determined, the number of lymphocytes was sharply reduced, and the reticular stroma was exposed; the percentage of labeled short- and long-lived lymphocytes was reduced. This decrease does not reflect the degree of devastation of the cortex in absolute values, but permits a comparison of the decrease in the number of long- and short-lived lymphocytes with respect to one another. Thus, if the percentage of short-lived cells was reduced 1.5-fold, that of long-lived cells was reduced 4.1-fold. However, in the destroyed cortex, regions were detected, usually situated at the boundary with the medullar layer, where the accumulation of cells resembling small and medium lymphocytes and a substantial number of vessels with cuboidal epithelium were noted. Probably these regions of the cortex correspond to the paracortical zone. The number of short-lived lymphocytes in the cortex and paracortical zones was almost the same, while there were significantly more long-lived lymphocytes in the paracortical zone than in the destroyed cortex. There are data on the fact that the paracortical zone is one of the regions that primarily contains long-lived cells. One day after irradiation of half the body, there were no centers of reproduction in the cortex of the irradiated lymph nodes; the amount of lymphoid elements is reduced to a lesser degree than in the case of whole-body irradiation. The labeled cells were diffusely scattered over the cortex and paracortical zone. The percentage of long-lived small lymphocytes in the cortex of the irradiated nodes were sharply reduced in the case of shielding of half the body, while that of short-lived lymphocytes was increased in comparison with the content of these cells in healthy animals. (tr-auth)

16811 (AEC-tr-7596, pp 115-118) DYNAMIC AND DOSE CHARACTERISTICS OF THE PROCESS OF DESTRUCTION OF LYMPHOID TISSUE OF IRRADIATED RODENTS. Strzhizhovskii, A. D. 1974. Translated from Radiobiologiya; 14: No. 3, 409-412(1974).
In Radiobiology.

The dynamic constants, and the dose dependence of these constants, of the process of destruction of lymphoid tissue of irradiated rodents are given. Cells of the thymus proved to be the most radiosensitive, while cells of the lymph nodes were the most radioresistant. (ERB)

16812 (AEC-tr-7596, pp 119-123) INFLUENCE OF STRESS ON THE MEMBRANE DIGESTION IN IRRADIATED ANIMALS. Lazovskaya, A. V. (Central Roentgenoradiological Scientific Research Inst., Leningrad). 1974. Translated from Radiobiologiya; 14: No. 3, 412-415(1974).
In Radiobiology.

The influence of stress on the digestive functions of the intestinal epithelium during the acute period of radiation sickness of animals and according to visible recovery is discussed. Such information is of practical importance in connection with the determining role of disorders of the digestive system in the pathogenesis of acute radiation sickness and the inevitability of various types of stress influences on the irradiated organism. In addition, these data permit an evaluation of the participation of regulating systems in the enzymatic activity of the intestinal epithelium. (tr-auth)

16813 (AEC-tr-7596, pp 124-128) RADIOPROTECTIVE EFFECTIVENESS OF CERTAIN AMIDINE DERIVATIVES OF SULFUR-CONTAINING COMPOUNDS. Vladimirov, V. G.; Kostyukovskii, Ya. L.; Slavachevskaya, N. M.; Strel'nikov, Yu. E. (Military Medical Academy, Leningrad). 1974. Translated from Radiobiologiya; 14: No. 3, 415-418(1974).
In Radiobiology.

The radioprotective activity of the most effective aminothiol radioprotectors is associated with the presence in their molecule not only of a sulfhydryl, but also of an amino group. In this work the radioprotective activity of sulfur-containing preparations in the case of replacement of the amino group by an amidine residue was studied. Such compounds were first synthesized by Johnston and Gallagher. The amidine and amino groups have approximately the same influence on the reactivity of the sulfhydryl group; however, the nature of the interaction of amidine compounds with proteins differs from the analogous reactions of amines. (tr-auth)

16814 (AEC-tr-7596, pp 129-132) RADIOPROTECTIVE EFFECT OF CERTAIN DERIVATIVES OF PYRAZOLONE AND HYDRAZINE. Piskarev, A. V.; Nesterenko, V. S. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 419-421(1974).
In Radiobiology.

Derivatives of pyrazolone and hydrazine increase the resistance of the organism to various unfavorable factors, including hypoxia, to which great significance is attributed in the pathogenesis of radiation sickness. In view of the fact that derivatives of pyrazolone (analgin, antipyrine, amidopyrine, butadione) and derivatives of hydrazine (apressin, phelazine) substantially increase the resistance of healthy and irradiated mice to hypoxia at all periods of acute radiation sickness, it is of interest to study the radioprotective action of these substances. (tr-auth)

16815 (AEC-tr-7596, pp 133-135) THERAPEUTIC ACTION OF PERORAL ADMINISTRATION OF A CULTURE OF ESCHERICHIA COLI IN ACUTE RADIATION SICKNESS. Strel'nikov, V. A. (Inst. of Biophysics, Moscow). 1974. Translated from Radiobiologiya; 14: No. 3, 421-423(1974).
In Radiobiology.

The intrinsic microflora of the organism plays a definite role in its resistance. It is known that ionizing radiation changes the general reactivity of the organism and its autoflora. Thus, in the intestines, against the background of an increase in the number of anaerobes, the amount of Escherichia coli decreases. On the other hand, the administration of colibacterin has a favorable influence on the course of dysbacterioses of various origins. The possibility of peroral administration of E. coli for the prevention of dysbacterioses in irradiated animals was studied. (ERB)

16816 (AEC-tr-7596, pp 136-138) SOME NEW PRINCIPLES CHARACTERIZING THE SPECIES RADIOSENSITIVITY OF MAMMALS. Shcherbova, E. N.; Gruzdev, G. P.; Ivanov, Yu. V. 1974. Translated from Radiobiologiya; 14: No. 3, 423-425(1974).
In Radiobiology.

The relationship between the size of the endothelial cell and the radiosensitivity of mammals was studied. The material used in the study was taken from the endothelium of the thoracic aorta of intact mice, rats, rabbits, guinea pigs, dogs, monkeys, pigs, and humans. A correlation was found between the area of the cytoplasm of the endothelial cells and the radiosensitivity of the mammals. (ERB)

16817 (AEC-tr-7596, pp 139-143) RESULTS OF A MATHEMATICAL ANALYSIS OF THE HEMATOLOGICAL DATA OF DOGS SUBJECTED TO CHRONIC GAMMA IRRADIATION FOR THREE YEARS. Popova, N. A.; Burkovskaya, T. E. 1974. Translated from Radiobiologiya; 14: No. 3, 425-429(1974).
In Radiobiology.

Changes in the indices of the peripheral blood and bone marrow of mongrel male dogs, subjected to chronic whole-body gamma irradiation from a ^{60}Co source for a period of 3 years, were detected by methods of dispersion and discriminant analyses and approximation with polynomials. The animals were divided into four groups of 18 dogs each: control; gamma irradiation at a rate of 0.06 rad/day; 0.17 rad/day; and 0.34 rad/day. Blood was collected from the vein of the forelimbs of the animals every 2 months in the morning hours before eating, and every 4 months bone marrow was sampled by puncture of the sternum. Such time intervals ensured independence of the data of each period of examination. The results of the preliminary examinations of the animals closest to the beginning of irradiation were taken as the initial values. The hemoglobin content, number of reticulocytes (pro mill), number of erythrocytes, thrombocytes, leukocytes, neutrophils, and monocytes per mm^3 of blood were studied; the number of nucleated cells per mm^3 of puncture specimen, the number of white cells (%), the number of red cells (%), the leukoerythroblastic ratio, the bone marrow indices, and the indices of maturation of the neutrophils and erythroblasts, and the content of plasma cells (%) in the bone marrow were also determined. (ERB)

16818 (AEC-tr-7596, pp 144-147) STATE OF THE REPRODUCTIVE FUNCTION IN MONKEYS THAT HAVE SUFFERED ACUTE RADIATION SICKNESS. Semenov, L. F.; Kosichenko, L. P.; Andreeva, A. V. (Inst. of Experimental Pathology and Therapy, Sukhumi, USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 429-431(1974).
In Radiobiology.

The reproductive capacity of males and the fertility of females in monkeys during the long-term period after acute radiation sickness was studied. It was found that monkeys that have suffered severe radiation sickness basically retained their generative function. After a period of temporary sterility, lasting about a year, females and males gave viable progeny. The young were born both after mating of one of the irradiated parents with a nonirradiated partner and from an irradiated pair. At the same time, the fertility of irradiated monkeys is lowered. In part of the animals stable sterility developed, which agrees with the data of the restoration of the structure and function of the sex glands of monkeys that have suffered radiation sickness, and in a number of cases on a prolonged preservation of the consequences of radiation damage. The decrease in the productivity of the irradiated monkeys depended not only on the decrease in the frequency of pregnancy, but also on the increase in the frequency of abortion and stillbirth. Pathology of pregnancy and birth is tripled in the case of irradiation both of males and of females. When irradiated partners were combined, the number of abortions and stillbirths exceeded the normal level by 5–6-fold. The first generation of irradiated monkeys did not exhibit any pathology and proved capable of giving normal progeny. A quantitative estimate of the fertility of the progeny of irradiated monkeys is being studied. (tr-auth)

16819 (AEC-tr-7596, pp 156-161) RADIOPROTECTIVE ACTION OF CERTAIN COMPONENTS FROM THE PLANT FODDER OF RADIORESISTANT RODENTS OF MIDDLE AND CENTRAL ASIA. Ogryzov, N. K.; Gilev, Yu. V.; Kuchinskii, B. D.; Petrov, L. N. (Perm State Univ., USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 437-440(1974).
In Radiobiology.

The radioprotective effectiveness of certain plants and mixtures of plants normally found in the diet of radioresistant rodents of middle and central Asia was studied in γ-irradiated rats. The investigated mixtures of plants were introduced into the diet of the experimental animals 2 weeks before irradiation with a minimum lethal dose. Of the 36 species studied, four species proved promising for the isolation of individual fractions exhibiting effective protection. (ERB)

16820 (AEC-tr-7596, pp 162-165) DYNAMICS OF THE CHANGE IN THE SECONDARY LUMINESCENCE OF PERIPHERAL BLOOD LEUKOCYTES AFTER X IRRADIATION. Sukhoviya, M. I. (Uzhgorod State Univ., USSR). 1974. Translated from Radiobiologiya; 14: No. 3, 441-443(1974).
In Radiobiology.

In a study of the primary and indirect action of ionizing radiation on the organism, fluorescence microscopy using acridine orange (AO), the nature of the fluorescence of which is determined by the state of the nucleic acids, may be promising. AO, exhibiting a denaturing effect, in the case of aggregation with the cell nucleic acids, leads to a transformation of their structure. In the presence of definite disorders in the cell, induced by the influence of radiation, the development of pathological processes will be accelerated when a fluorochrome is added. Consequently, the dynamics of the interaction of AO with the cell components can be used for an estimation of the degree of radiation damage to the nucleic acids, primarily DNA. For this purpose, a method is proposed of initiation of destructive changes in the leukocytes by means of prolonged exposure of the peripheral blood in vitro with acridine orange. (tr-auth)

16821 (CEA-N-1744) CHARACTERISTICS OF CATARACTS INDUCED BY PROTON IRRADIATION IN THE RABBIT. Lemaire.

G.; Haye, C.; Grillon, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Aug 1974. 29p. (In French). Dep. NTIS (US Sales Only) $4.50.

Even if injuries by proton irradiation of the rabbit eyes are of the same nature as injuries by other ionizing radiations, the evolution of the pathological processes induced by protons are different since the injuries become stable at a precise stage of cataractogenesis. The localization of the radiosensitive sites, i.e., the germinative epithelium of the lens equator, was verified and the lack of a LET effect shown by a RBE always lower than 1 was demonstrated. (FR)

16822 (LA-UR-74-1887) INITIAL COMPARATIVE RESPONSE OF EXPERIMENTAL TUMORS TO PEAK PIONS AND X-RAYS. Kligerman, M. M.; Dicello, J. F.; Davis, H. T.; Thomas, R. A.; Sternhagen, C. J.; Gomez, L.; Petersen, D. F. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd] Contract W-7405-eng-36. 12p. (CONF-741230-1). Dep. NTIS $4.00.

From Radiological Society of North American Conference; Chicago, Illinois, USA (1 Dec 1974).

A mammary adenocarcinoma which had arisen spontaneously was transplanted subcutaneously into the backs of C_3H mice and irradiated with pion beams and 250 Kv x radiation delivered at a dose rate of 300 rads/min at several dosage levels. The daily fractions of total peak pions were 264, 352, and 440 rads for a total dose of 1320, 1760, or 2200 rads, and the x-ray doses for each of five fractions were 476, 634, 794, 1055, and 1321 rads for a total dose ranging from 2380 to 6605 rads. Depth dose curves and dose distributions for the pion beam were measured with 0.1 cc thimble-type tissue equivalent ionization chambers calibrated with respect to a $^{60}Co\ \gamma$ source and 250 Kv x-rays. The tumors were measured in three dimensions and their volumes calculated three times a week, and they were examined for regression, repression, and regrowth, and the probability of cell survival was estimated. The RBE of 1.67 ± 0.148 was established for use in considering doses for human radiobiology experiments. (CH)

16823 (ORNL-tr-2888) DYNAMICS OF CHANGES IN OVARIES, PITUITARY, AND ADRENALS IN LATENT PERIOD OF RADIATION-INDUCED CARCINOGENESIS. Pavlenko-Mikhailov, Yu. N. Translated by Martha Gerrard from Vop. Onkol.; 18: No. 10, 87(1972). 1p. Dep. NTIS $4.00.

The dynamics of morphological changes were studied in the ovaries, hypophysis, and the adrenal gland during the latent period (180 days) of radiation-induced tumor formation. White rats were irradiated with a 200-R ^{60}Co gamma (whole body) to dose. An interrelationship appeared in the morphological changes in the adenohypophysis and the ovaries during the 180 days. This abstract, prepared from the original Russian language publication, appeared in NSA Vol. 28 as number 8460. (CH)

16824 CHANGE OF POLYSACCHARIDE AND NUCLEIC ACID METABOLISM IN THE CNS AND BLOOD OF EXPERIMENTAL ANIMALS UNDER IRRADIATION. Tskhadadze, M. Sh. Soobshch. Akad. Nauk Gruz. SSR; 76: No. 3, 713-715(Dec 1974). (In Russian).

The change of nucleic and polysaccharide metabolism in the neurons and blood of irradiated animals indicates a reduction of their metabolic activity, affecting the energetic potentials of the cell. Experimental findings show that during radial injury there takes place a color intensity change of nucleic acid and polysaccharide. Polymerization of desoxyribonucleic acid abruptly changes. Such a change of color intensity points to alterations that occur in metabolism. The present findings reveal that there takes place a metabolic change in the CNS and in the hemacytes of white blood. Whereas polymerized desoxyribonucleic acid is not observed in the norm and the quantity of depolymerized desoxyribonucleic acid is also lowered, a high quantity of polymerized desoxyribonucleic acid is observed in the CNS and blood of irradiated animals. (auth)

16825 FUTURE RESEARCH IN MOUSE RADIATION GENETICS. Russell, W. L. (Oak Ridge National Lab., TN). Genetics; 78: No. 1, 135-138(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

Some suggestions for future research projects are as follows: collection of further data on mutation frequency induced in mouse spermatogonia at very low radiation dose rates; research on mutation frequency at low dose rates in late dictyate oocytes; investigations on the actual nature and effect of the individual mutations induced by radiation; induction of mutations at the hemoglobin loci; and estimation of genetic hazards of radiation in man. (HLW)

16826 NATURE AND CONSEQUENCES OF INDUCED CHROMOSOME DAMAGE IN MAMMALS. Searle, A. G. (Medical Research Council, Harwell, Eng.). Genetics; 78: No. 1, 173-186(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

There are marked qualitative and quantitative differences in the patterns of chromosomal damage observed after irradiation of spermatogonia, spermatozoa and oocytes of mice. These differences often result from reduced or zero transmission of particular classes of aberration arising in pre-meiotic germ cells. Probably this is the reason why the level of X-chromosomal and autosomal monosomy is not increased after spermatogonial irradiation. Similarly, the reduced transmission of certain d-se deficiencies may help to explain their low F_1 frequency after pre-meiotic as compared with later irradiation. Spermatozoal irradiation has revealed no Robertsonian translocations, but has produced some types of reciprocal translocations which apparently are not transmitted to the F_1 after spermatogonial treatment because they prevent maturation of the male pre-meiotic germ cell. Thus they cause sterility in males, but not in females. They include X-autosome and Y-autosome translocations, those giving a metacentric or sub-metacentric chromosome (with reciprocal product present) and those in which one break-point is in or near the centromeric heterochromatin while the other is more distally placed. This last group (which grades into male sub-fertile conditions) gives a preponderance of chain configurations (often with one separate univalent) in heterozygotes of both sexes at meiosis and a high incidence of somatic marker chromosomes. Nondisjunction associated with the univalent generates tertiary trisomics, which are usually male-sterile also and may show phenotypic abnormalities. Sterile males with complete separation of X and Y chromosomes have also been reported after mutagenic treatment of meiotic and post-meiotic germ cells. Such separation seems to prevent a primary spermatocyte from forming a secondary one. The usual derivation (in mouse and man) of tertiary trisomics from mothers rather than from fathers may be due to a similar block, together with a general tendency for male heterozygotes for the parental balanced translocation to be sterile or sub-fertile. Mature oocytes tend to resemble spermatozoa in the types of aberration produced by irradiation, which include the male-sterile translocation, but more data are needed. Many of the aberrations described contribute to the human cytogenetic load and can be studied in the mouse from this point of view. (auth)

16827 CHANGES IN ENZYMATIC ACTIVITY IN ABSORPTION CELLS OF SMALL INTESTINE IN WHOLE-BODY ^{60}Co-IRRADIATED GUINEA PIGS. Otoupal, P. (Military Veterinary Research Inst., Prague); Hrusovsky, J.; Lojda, Z. Vet. Med. (Prague); 18: No. 8, 515-521(Aug 1973). (In Czech).

In guinea pigs, $3\frac{1}{2}$ and 12 months old, respectively, whole-body irradiated with 260 R of ^{60}Co radiation (lower than $LD_{50/30}$), small intestine enterocytes were studied histochemically. The study aimed at ascertaining the activity of alkaline and acid phosphatases, leucyl-β-naphtylamidase, sucrase, trehalase, non-specific esterase, α-glycerolphosphatedehydrogenase, and succinodehydrogenase. After 12 hours following exposure, a decreased activity was observed of non-specific esterase, acid phosphatase and partly also of succino-dehydrogenase and α-glycerolphosphate-dehydrogenase. Disaccharidases and leucyl-β-naphthylamidase showed a transient increase in activity. The enzymatic activity returned to normal in all groups of experimental animals after three to five days following exposure. The same results were observed in enterocytes in various regions of the small intestine. The changes were found to start earlier in younger animals than in the 12 month-old group. The investigations show that digestive and metabolic capabilities of enterocytes altered as a result of exposure to a dose lower than $LD_{50/30}$, this within three days after irradiation. (Nucl. Sci. Abst. Czech)

16828 THE RE-EPITHELIZATION OF INTESTINAL MUCOSA IN GAMMA-IRRADIATED, PARTIALLY SHIELDED GNOTOBIOTIC PIGLETS. Mandel, L.; Moravek, F.; Miler, I. (Ceskoslovenska Akademie Ved, Prague. Lab. of Gnotobiology; Ceskoslovenska Akademie Ved, Prague. Mikrobiologicky Ustav; Vojensky Lekarsky Vyzkumny a Doskolovaci Ustav J. E. Purkyne, Hradec Kralove (Czechoslovakia)). Strahlentherapie; 147: No. 3, 308-314 (Mar 1974).

4 figs.; 12 refs.

Germ-free and E. coli 0.54 monoassociated piglets, partially shielded, survived after the exposure to 1,800 or 2,400 R for 14 to 20 days, whereas their conventional counterparts did so only 4 to 8 days. Both the haemorrhagic diathesis and partial denudation of the intestinal epithelium are considered to be the cause of death in gnotobiotic piglets, whereas in conventional animals a typical gastrointestinal syndrome occurred. In gnotobiotic animals, the beginning of the re-epithelization of the intestinal mucosa was observed at the time of death. (auth)

16829 POSSIBILITIES AND LIMITATIONS OF BIOLOGICAL INDICATORS OF RADIATION INJURY. Skalka, M. (Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav). Cas. Lek. Cesk.; 112: No. 31, 950-955(Aug 1973). (In Czech.).

The concept of biological indicators is discussed and their application is advocated in place of previously used biological dosemeters. The principal task of biological indicators is defined as the determination of the degree of radiation injury as against the task of biological dosemeters, which is the determination of the dose of radiation. Methods are reviewed that can be applied in indicating radiation injuries. The greatest advantages are offered by the morphological and the biochemical examinations of peripheral lymphocytes. (INIS)

16830 DAMAGE TO MOUSE LUNG WITH NEUTRONS AND X-RAYS. Field, S. B. (Medical Research Council, London); Hornsey, S. Eur. J. Cancer; 10: No. 9, 621-627(Sep 1974).

Mice die of radiation pneumonitis between 80 and 180 days after irradiation of the thorax. Using the endpoint of LD$_{50}$, the RBE for fast neutrons was measured and shown to be low compared to most other normal tissues. The effects of fractionation of x rays were similar to those found in other tissues. A maximum sparing, obtained by measurement of D$_2$-D$_1$, was found to be about 500 rads of x rays at an interval of 6 hr between doses. It has been tentatively attributed to repair of sublethal damage of surviving cells. For time intervals greater than 6 hr between doses, the LD$_{50}$ was increased by about 8 rads per day up to 28 days. This increase was attributed to a slow repopulation of surviving cells. (auth)

Invertebrates

Refer also to abstracts 16762 and 19151.

16831 (COO-1748-14) NEUTRON-INDUCED MUTATION EXPERIMENTS. Progress Report, March 1, 1974–February 28, 1975. Abrahamson, S.; Valencia, R.; DeJongh, C. (Wisconsin Univ., Madison (USA)). [nd]. Contract AT(11-1)-1748. 16p. Dep. NTIS $4.00.

Experiments using Drosophila have been initiated to study the mutagenic effectiveness of neutrons of different energies. The genetic work is being done at the University of Wisconsin and the irradiations are being done at Brookhaven National Laboratory. The effects being scored are sex-linked recessive lethals and mutations at specific loci. The energies and doses used in the six irradiations carried out to date are .68 MeV (250 and 500 Rads) and 14 MeV (500 and 1000 Rads). The data collected to date, in five months of work, is mostly insufficient for discussion, but the recessive lethal data for .68 MeV neutrons does indicate an effectiveness much greater than that of x rays at similar doses. (auth)

16832 (UR-3490-659) AGE-CORRELATED SOMATIC RADIOPROTECTION OF DROSOPHILA MELANOGASTER IMAGOES IN SELECTED ENVIRONMENTS DURING IRRADIATION. Lopez-Villegas, A. E. (Rochester Univ., N. Y. (USA)). 1974. 223p. Dep. NTIS $14.25.

Thesis.

Imaginal stages of Drosophila melanogaster were exposed to a wide range of doses of γ irradiation (between 0 and 180 kilorads) in the presence of air or of selected environments. These environments, carefully controlled at the time irradiation took place, were: 100% nitrogen gas, 100% carbon dioxide gas, 100% oxygen, a gas mixture of 50% oxygen and 50% carbon dioxide, and reduced atmospheric pressure, such as 20, 40, 60, and 80 torr. The age of the imagoes, chosen to cover an ample range of the life span of the insects, were 1, 10, 20, and 30 days. Radiation damage to the imagoes, as evidenced by shortening of insect life span, was greatly reduced when irradiation took place in atmospheres of nitrogen or carbon dioxide or at 40 torr of reduced atmospheric pressure. (CH)

16833 RADIATION EFFECTS ON SEGREGATION IN DROSOPHILA. Parker, D. R. (Leiden Univ.); Williamson, J. H. Genetics; 78: No. 1, 163-171(Sep 1974).

From 13th international congress of genetics; Berkeley and Davis, CA (20 Aug 1973).

Translocation induced in the immature oocyte, in meiotic prophase, affects division I orientation and segregation, the usual result being that the two halves of translocations are directed to opposite poles. Since interchange is usually (if not exclusively) between chromatids, this is to be expected from the creation of illegitimate conjunctions. Good agreement is obtained between patterns of segregations deduced from recovered half-translocation bearing exceptions and the kinds of disomic gametes expected as alternative recoveries from the same division I configurations. Inferences drawn from the study of compound-X females have been found to apply as well in the case of females of normal karyotype. Numerical errors occur predominantly, possibly exclusively, in division I. The rate of induced nondisjunction of specific chromosome pairs varies in relation to the structure of the entire complement, as required if radiation-induced nondisjunction is interchange dependent, but which would be unexpected if the mechanism involved effects on individual spindle fibers, chromosomes, or chromosomal bivalents. (auth)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 16524, 16777–16780, and 16789.

16834 (AEC-tr-7595, pp 132-145) TUMORS OF THE LUNGS. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

Topics covered include: clinical observations, general characteristics of cancer of the lungs that developed in miners who extracted radioactive ore, characteristics of radioactive contamination of the air in the mines of Schneeberg and Joachimsthal, and experimental investigations. (MCG)

16835 (AEC-tr-7595, pp 146-158) TUMORS OF THE LIVER. Dec 1974. Translated from Blastomogennoe Deistvie Ioniziruyushchei Radiatsii, Izdatel'stvo Meditsina, Moscow, 1964.

In blastomogenic action of ionizing radiation.

Topics covered include: clinical observations; experimental reproduction of hepatomas, characteristics of liver tumors that developed in man under the influence of Thorotrast; incidence of tumors in rats primed with ^{144}Ce, ^{147}Pm, and ^{140}La; incidence of hepatomas in rats as a function of dose and the dose rate generated in the hepatic tissue by ^{144}Ce; and incidence of hepatic adenomas in mice that received radioactive gold intravenously. (MCG)

16836 (BNWL-B-389) DACRIN: A COMPUTER PROGRAM FOR CALCULATING ORGAN DOSE FROM ACUTE OR CHRONIC RADIONUCLIDE INHALATION. Houston, J. R.; Strenge, D. L.; Watson, E. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-1830. 158p. Dep. NTIS $11.00.

The lung model, proposed by the ICRP Task Group on Lung Dynamics, permits a more realistic calculation of radiation dose to the human respiratory tract from the inhalation of radioactive aerosols than does the initial ICRP lung model. As is the case with most models the more closely the model approaches reality the more complex the mathematics describing the model become. This quantum increase in complexity has removed the calculation of the dose to an organ following inhalation of a radionuclide from the convenient realm of the slide rule and simple desk top calculator. This is particularly true when calculating the radiation dose to internal organs other than the lung. A computer program (DACRIN) is presented that was designed to quickly and easily compute the effective dose to the respiratory tract and other organs and tissues of interest following either acute or chronic inhalation of a radioactive aerosol. A detailed description of the mathematical models used in the code is included. (CH)

16837 (BNWL-SA-4911) SUMMARY AND SPECULATIVE INTERPRETATION RELATIVE TO EXPOSURE LIMITS. Thompson, R. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 18p. (CONF-740715-20). Dep. NTIS $4.00.

From fifth international radiation research congress meeting; Seattle, Washington, USA (14 Jul 1974).

For most radionuclides, occupational exposure limits are set in such a manner as to limit the radiation dose to the critical organ to some acceptable level. This acceptable level is derived from the total experience with human irradiation, which is mostly experience with uniform irradiation from external sources. These limits, such as 5 rem per year to total body, and 15 rem per year to organs like liver and lung, bear little experimental relationship to irradiation by internally deposited radionuclides. Plutonium is particularly difficult to fit into this scheme of limit setting, since there is frequently not a clear choice of critical organ. Animal studies show that, under the same conditions of exposure, either lung or bone tumors may develop; under other conditions, either bone or liver tumors; and the radiation dose to lymph nodes may frequently exceed greatly the dose to any other tissue. The radiation dose from Pu is always very non-uniformly distributed within an organ, due to the natural predilection of Pu for certain deposition sites, as for example on bone surfaces or in the reticuloendothelial cells of liver; to the particulate nature of most forms of Pu that gain entry to the body; and to the aggregation of Pu by macrophage engulfment, and other processes, subsequent to initial deposition. For all of these reasons it is difficult to know how to calculate a biologically relevant radiation dose from deposited Pu. One may average the dose over the total body, over an organ, over some anatomically defined portion of an organ, or one may calculate the dose within some chosen volume of tissue immediately adjacent to the deposited plutonium. However one chooses to average, measure, or calculate dose, the numbers obtained are only numbers, and they have meaning for limit setting purposes only insofar as they can be related to a biological effect. There is little to be said of the data on effects of Pu in humans, except that there are no data, which is the most encouraging data one could have, although information is available on a substantial number of workers with Pu depositions exceeding the current permissible limit. The absence of demonstrable effects in these people, many of whom received their exposures more than 25 years ago, is certainly presumptive evidence that the exposure limits are not grossly inadequate. The accumulating information on distribution of Pu in man based on autopsy data also forms a very important link between animal experimentation and human prediction. Data are summarized from studies on the dose-response relationships of pathological changes in the lungs of laboratory animals following inhalation of ^{238}Pu and ^{239}Pu in a wide variety of chemical forms. It is probably significant that the experiment showing the highest lung cancer incidence in the lower-dose ranges was the only experiment employing ^{238}Pu, and probably the experiment in which the plutonium was most nearly uniformly distributed. (CH)

16838 (DHEW-(NIH)-75-683, pp 302-316) EFFECTS OF SKELETAL RADIUM DEPOSITS ON BONE MINERALIZATION. Schlenker, R. A.; Oltman, B. G. (Argonne National Lab., IL). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement. Measurements of bone mineralization are reported for 281 women over 40 who have abnormally high body burdens of radium or who have a history of exposure to radium. The measurements were made at the midshaft and distal end of the radius. No significant differences are found in the bone mineralization between women with body burdens less than 0.003 μCi and with body burdens between 0.003 and 0.1 μCi. The rate of demineralization in women over 60 who have body burdens greater than 0.1 μCi is twice as great as in women over 40 who also have body burdens but less than 0.1 μCi. The difference in rates of demineralization is statistically significant at the 95% level. Only a small sample of women with body burdens greater than 0.1 μCi was studied so that this result must be considered tentative. (auth)

16839 (NRPB-R-29) RADIOLOGICAL PROBLEMS IN THE PROTECTION OF PERSONS EXPOSED TO PLUTONIUM. Dolphin, G. W.; Smith, H.; Popplewell, D. S.; Stather, J. W.; Adams, N.; Spoor, N. L.; Brightwell, J.; Bulman, R. A. (National Radiological Protection Board, Harwell (UK)). Sep 1974. 57p. (ISBN-0-85951-028-X). National Radiological Protection Board, Harwell, Eng. 50 pence.

For the protection of persons exposed to plutonium isotopes and higher actinides there are five important requirements. First it is essential to evaluate all the appropriate data and develop basic dose standards for control of exposure of body organs, particularly bone, liver and lung; these must be comparable to standards for exposure to external gamma and x radiation. Secondly, from these basic standards, values for maximum permissible concentrations in air and permissible annual intakes must be derived using metabolic models for plutonium in humans. As part of the biological monitoring of workers it is necessary to make assessments of the amount of plutonium in the body either by measurement of the excretion rate of plutonium in the urine or by external counting of gamma or x radiations over the chest or contaminated wound site. For the treatment of cases of high overexposure therapeutic techniques should be available for accelerating the excretion or removal of the radioactivity from the body. Finally, plans must be made to cover the possibility of a large release of plutonium into the environment and these should include acceptable values for ground contamination levels. Relevant data on these five subjects are reviewed in this report. (auth)

16840 (ORNL-5000) TABULATION OF DOSE EQUIVALENT PER MICROCURIE-DAY FOR SOURCE AND TARGET ORGANS OF AN ADULT FOR VARIOUS RADIONUCLIDES. Snyder, W. S.; Ford, M. R.; Warner, G. G.; Watson, S. B. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 345p. Dep. NTIS $10.60.

A tabulation is presented of the average dose equivalent in various target organs per microcurie-day of activity in a source organ. For each of some 60 radionuclides and each source and target organ, the dose equivalent due to photons, electrons, alpha particles, and recoil nuclei is given, each computed with the appropriate quality factor recommended by ICRP and NCRP. The total dose equivalent is listed also. Source organs include cortical bone, cancellous bone, and active bone marrow as well as other organs usually of concern to health physicists. Bone as a whole, endosteal cells (taken to lie within 10 μm of endosteal surfaces), red (active) marrow, and yellow marrow are indicated as target organs in addition to the organs usually considered in radiation protection programs. The absorbed fractions of photon energy have been recomputed using the methods developed in MIRD Pamphlet No. 5 but are based on a somewhat more realistic phantom than that used in the earlier calculation. When the Monte Carlo calculation did not give a sufficiently accurate result, various approximate procedures were used, and these are described. The tabulation is convenient to use because it avoids separate consideration of each product of the decay scheme and does not imply any restriction on the metabolic model to be used. However, the sources are considered to be uniformly distributed in the source organ, and only an average dose equivalent in the target organ is estimated. (auth)

16841 (UCRL-76307) MODELING THE DOSE TO MAN FROM EXPOSURE TO TRITIATED WATER VAPOR. Anspaugh, L. R.; Peterson, K. R.; Robison, W. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1974. 14p. (CONF-750109-3). Dep. NTIS $4.00.

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

The modeling approaches outlined in this paper were used in estimating individual and population exposures from tritium transport and uptake for both contained and excavation applications. The dry deposition model was used for predicting the dose to man from flaring of gas from U. S. nuclear gas stimulation experiments. The rainout model was used to estimate doses for several proposed nuclear excavation projects. (auth)

16842 SYNOVIORTHESIS WITH ^{90}YTTRIUM. Mueller, W. (Basel Univ. (Switzerland). Rheumatologische Klinik und Poliklinik); Fridrich, R. (Basel Univ. (Switzerland). Nuklearmedizinische Abt.). Deut. Med. Wochenschr.; 99: No. 19, 996-1000(May 1974). (In German).

3 Tabs.; 42 refs.

^{90}Y was injected into 64 joints of 41 patients with chronic rheumatoid arthritis of long-persisting joint effusions related to degenerative joint disease. After intraarticular injection of ^{90}Y in adequate dosage (3 to 6 mCi) complete disappearance of the inflammatory changes occurred in 34, while partial therapeutic effect was achieved in 22 joints. No change occurred in eight joints. These results and those reported by others indicate that ^{90}Y synoviorthesis now serves as an alternative method to surgical synovectomy, especially in elderly patients. Side effects are slight. But possible late damage can as yet not be assessed so that indications should still be strict. Large joints, especially of the knee, are particularly suitable for ^{90}Y synoviorthesis, while other radioisotopes must be used for smaller joints. (auth)

16843 CHROMOSOME ABNORMALITIES OF THE LYMPHOCYTES IN THYROID STUDIES WITH ^{131}I. Zseboek, Z. B.; Sellyei, M.; Baumgartner, E. (Univ., Budapest). pp 253-255 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Chromosome abnormalities in lymphocyte cultures from patients suffering from a variety of thyroid diseases were studied. In such cases abnormalities arose 48 hrs. after the oral administration of 50 μCi/^{131}I. As a control, chromosome preparations were made from the same patient directly before the isotope examination. Abnormal chromosomes could be found in patients with increased thyroid function. (auth)

16844 LYMPH SCINTIGRAPHY AFTER ENDOLYMPHATIC RADIOISOTOPIC THERAPY. Wolf, G.; Canigiani, G. (Univ., Vienna). pp 273-280 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

In 50 patients undergoing radioisotope therapy, lymphscintigraphy has been carried out with the object of investigating the lymphatic system. Scintigrams were carried out before and after therapy using ^{32}P. Its effects on the characteristics of the lymphatic system are reported. These facts may be related to the treatment of diseases involving the lymphatic system (e.g., Hodgkin's Disease). (auth)

Animals

Refer also to abstracts 16781, 16790–16794, 16834, 16862, 16866, 16872, 16888–16891, and 18668.

16845 (AEC-tr-7596, pp 58-61) PNEUMOSCLEROSIS AND TUMORS OF THE LUNGS IN RATS AFTER INTRATRACHEAL ADMINISTRATION OF AMERICIUM-241. Filippova, L. G.; Nifatov, A. P. 1974. Translated from Radiobiologiya; 14: No. 3, 366-368(1974).

In Radiobiology.

The long-term consequences of lesion of the lungs after intratracheal administration of americium-241 nitrate in the dose range 0.0004 to 2.22 μCi per rat were studied. It was shown that americium-241 nitrate in an amount of 0.23 to 2.22 μCi increases the frequency of appearance of pneumosclerosis and lung cancer in comparison with the control, depending on the dose of the isotope introduced. (tr-auth)

16846 (AEC-tr-7590, pp 194-202) BIOLOGICAL EFFECTS OF STRONTIUM-90, CESIUM-137, AND PROMETHIUM-147 WITH CHRONIC INTAKE OF SMALL DOSES BY MOUTH. Nifatov, A. P.; Buldakov, L. A. Dec 1974. Translated from pp 183-191 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Rats were given ^{90}Sr, ^{137}Cs, and ^{147}Pm by mouth for 600 days. Observations were made on blood composition, body weight, survival time, and development of tumors in the endocrine glands, reproductive organs, mammary glands, gastrointestinal tract, lungs, and skin. It was concluded that the isotopes had no effect on these factors. (HLW)

16847 (AEC-tr-7590, pp 203-213) BIOLOGICAL EFFECTS OF STRONTIUM-90 AS RELATED TO DURATION AND RATE OF INTAKE. Moskalev, Yu. I.; Strel'tsova, V. N.; Teplinskaya, G. N. Dec 1974. Translated from pp 192-201 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Strontium-90 was administered intraperitoneally to rats in doses of 50 to 1,000 μCi per rat. The doses were given daily for 10 or 100 days, or in divided doses at 2 week intervals, or at 1 month intervals. The incidences of bone tumors, depression of leukopoiesis, thrombocytopoiesis, weight loss, and decreased survival time were more marked after single doses. Development of leukemia and anemia were minimally related to the mode of administration. (HLW)

16848 (AEC-tr-7590, pp 214-221) EXPERIMENTAL TOXICITY OF TRITIUM. Zhuravlev, V. F. Dec 1974. Translated from pp 202-208 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

When given to rabbits by mouth, tritium oxide induces radiation sickness. The severity of the process is directly related to the dosage given. Administration of tritium oxide to rabbits in a dosage of 0.3 Ci/kg induces mild radiation sickness; a dosage of 0.4 Ci/kg, a severe form of sickness, and 0.5 Ci/kg, lesions in an extremely severe form. When animals are given tritium oxide in a dosage of 0.3 Ci/kg there is gradual normalization of blood and disappearance of clinical disturbances. There is little difference between the symptomatology of acute lesion due to tritium oxide and that of radiation sickness induced by external irradiation. The difference consists of a shorter latency period, earlier manifestation of all clinical symptoms and presence of radioactive substance in the organism. (auth)

16849 (AEC-tr-7590, pp 222-225) CHANGES IN THE CANINE BLOOD SYSTEM FOLLOWING INTRAVENOUS ADMINISTRATION OF YTTRIUM-91. Petrovich, I. K.; Shchelkonogova, M. I. Dec 1974. Translated from pp 209-212 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Yttrium-91 given intravenously in a single dosage of 0.1 to 0.2 mCi/kg elicits severe changes in canine peripheral blood and hemopoietic organs. At the acute phase of radiation sickness, with administration of 0.1 mCi/kg ^{91}Y, leukopenia is observed between the 3rd and 5th weeks referable to neutrophils, as well as decrease (by 30%) in erythrocyte count in the 4th–7th weeks, and in thrombocytes during the 2nd–3rd week after administration. In animals that survived the acute phase of lesion, erythropoiesis is restored starting in the 3rd month, while leukopoiesis remains depressed (by 50%) all of the time (up to 14 months after administration of the isotope), as compared to the initial levels. (auth)

16850 (AEC-tr-7590, pp 230-237) EFFECTS OF ADDITIONAL PATHOLOGICAL FACTORS ON PERIPHERAL BLOOD OF RATS GIVEN PLUTONIUM-239. Kudasheva, N. P.; Koshurnikova, N. A. Dec 1974. Translated from pp 217-224 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Plutonium nitrate solution was administered to rats intraperitoneally; some rats were subjected to multiple bloodletting and others were given turpentine. Observations were made on survival time, body weight, and numbers of blood cells. Results indicated that there was no appreciable change in any of these factors following injection of ^{239}Pu. (HLW)

16851 (AEC-tr-7590, pp 238-242) HEMOPOIESIS IN DOGS SUBMITTED TO SUBACUTE PLUTONIUM-239 INTOXICATION. Baisogolov, G. D.; Podgorodetskaya, V. N. Dec 1974. Translated from pp 225-229 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Plutonium nitrate was administered to dogs intravenously and hemopoiesis was studied for one year. Tables are presented to show quantities of erythrocytes, hemoglobin, reticulocytes, thrombocytes, leukocytes, neutrophils, and lymphocytes at various intervals following injection of ^{239}Pu. (HLW)

16852 (AEC-tr-7590, pp 243-250) OXYGENATION OF RAT BLOOD FOLLOWING INHALATION OF PLUTONIUM-239. Kalmykova, Z. I. Dec 1974. Translated from pp 230-236 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Impaired oxygenation of blood, alternating with periods of normalization, develops in rats following inhalation of plutonium citrate. The severity and duration of these disturbances is related to the quantity of α emitter deposited in the lungs: the more radioisotope present, the more marked were the changes. Disturbances referable to oxygenation of blood were the most distinctly demonstrable with the functional test involving brief asphyxia. With reference to hematological indices, we failed to demonstrate significant quantitative changes in the 8-month observation period in rats given plutonium citrate by inhalation. (auth)

16853 (AEC-tr-7590, pp 251-256) EFFECTS OF ASEPTIC INFLAMMATION ON LONG-TERM SEQUELAE IN RATS GIVEN PLUTONIUM-239. Koshurnikova, N. A.; Lemberg, V. K. Dec 1974. Translated from pp 237-242 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

These experiments revealed that aseptic inflammation combined with small doses of ^{239}Pu curtails survival of experimental females. Aseptic inflammation diminishes the incidence of bone and hemopoietic tissue tumors in rats of both sexes. Multiple injections of turpentine, administration of small doses of ^{239}Pu, as well as the combination of these two factors, induce some rise in incidence of neoplasms of endocrine glands in experimental rats. The question of the change in death profile, as well as the decrease in incidence of bone and hemopoietic tissue tumors under the influence of turpentine, requires further investigation on a large number of animals with the use of several doses of plutonium, including optimum blastomogenic doses. (auth)

16854 (AEC-tr-7590, pp 257-265) BONE TUMORS IN DOGS GIVEN PLUTONIUM-239. Lemberg, V. K. Dec 1974. Translated from pp 243-250 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Malignant skeletal tumors were demonstrated in 6 out of 8 dogs that survived over 2 years after intravenous administration of plutonium nitrate in a cumulative dosage of 0.2 μCi/kg. In dogs given the above dosage of plutonium, the latency period of osteosarcoma development constitutes a mean of 1421 days, or 32.5% of mean life expectancy. Four of the seven osteosarcomas described developed in the epi-metaphysial region of long bones (femur, humerus and tibia), two developed in the vertebrae, and one in the scapula. Histologically, six osteosarcomas were of the osteoplastic type and one was of the osteolytic type. (auth)

16855 (AEC-tr-7590, pp 266-287) PATHOLOGICAL ANATOMY OF PROMETHIUM-147 INDUCED RADIATION LESION. Strel'tsova, V. N. Dec 1974. Translated from pp 251-272 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Acute radiation lesion in rats, induced by the soft β emitter ^{147}Pm, is characterized by aplastic changes in hemopoietic tissue of the bone marrow and spleen, capillary circulatory disorders in the liver with atonia and persistent dilatation of capillaries and small veins, degenerative changes in the parenchyma of the liver and kidneys (protein, fatty degeneration, necrosis), and necrobiotic changes in the intestinal mucosa on the order of necrotic ulcerative enterocolitis. Subacute radiation lesion induced by ^{147}Pm proceeds as specific parenchymatous hepatitis with a labile correlation between degenerative, proliferative, repair, and sclerotic processes, and development of cirrhosis against the background of atrophic changes in hemopoietic organs, associated with lymphopenia, leukopenia and erythropenia. Chronic ^{147}Pm induced lesion is characterized by polymorphism of pathological processes. At this phase of sickness, there is prevalence of various pathological processes: tumors of varying localization (osteosarcoma, malignant and benign soft tissue tumors) or hepatic pathology (chronic hepatitis and cirrhosis), hyperplastic neoplastic pathology of hemopoietic organs (leukemia), panvasculitis of the polyarteritis nodosa type. (auth)

16856 (AEC-tr-7590, pp 288-302) PATHOLOGICAL ANATOMY OF NIOBIUM-95-INDUCED RADIATION LESION. Strel'tsova, V. N. Dec 1974. Translated from pp 273-288 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

The following signs are typical for acute lesion induced in rats by ^{95}Nb (18–9 μCi/gram): initial depression of medullary hemopoiesis followed by restoration thereof on the 14th to 16th day and rapid normalization of the ratio between juvenile and mature cell forms; prevalence of degenerative and necrobiotic changes in parenchymatous organs with particularly severe involvement of the kidneys where necrosis and calcification of the epithelium of secondary convoluted tubules develop in about 57% of the cases; early depression of spermatogenesis with disappearance of germ cells. Subacute ^{95}Nb lesion (9, 4.5 and 1.1 μCi/gram) is characterized by: coexisting atrophic, degenerative, and regenerative processes in parenchymatous organs. At this stage, with reference to medullary hemopoietic tissue, there is typical predominance of recovery processes, whereas in lymphoid tissue there are concurrent processes of destruction and de novo production of lymphoid cells with prevalence of the former process; arrested spermatogenesis and degenerative changes in renal parenchyma (granular regeneration and necrosis of convoluted tubule epithelium); concomitant nonspecific inflammatory processes, of bacterial nature, in 100% of the cases. Chronic ^{95}Nb lesions in rats (6.3, 4.5, 2.25, and 1.1 μCi/gm) are characterized by: development of benign and malignant tumors of the mammary glands, small intestine, subcutaneous cellular tissue, hemopoietic organs (reticulosis) in 25% of the rats that survive for over 200 days or 17% of all experimental rats. Tumors develop the most often (50%) with intraperitoneal administration of 6.3 μCi/gram; hyperplasia of reticuloendothelial elements of bone marrow, spleen and liver in excess of the age-related norm; isolated cases of reticulosarcomatosis; and depression of spermatogenesis. (auth)

16857 (WASH-1359, pp 171-229) BIOLOGICAL EFFECTS OF TRANSURANIUM ELEMENTS IN EXPERIMENTAL ANIMALS. Bair, W. J. (Battelle-Pacific Northwest Labs., Richland, WA). Dec 1974.

In plutonium and other transuranium elements.

Radiation hazards to man from the transuranium elements involve occupational exposures in the work environment and hazards to the general population from exposure to very low levels of the transuranium elements. The major health effects of the transuranium elements are due to their emission of α radiation and the nature of the effects depends upon which tissues are irradiated following deposition in the body. Data are reviewed from studies in laboratory animals of the tissue distribution and late pathological effects of transuranium elements following inhalation, ingestion, or deposition on skin. Extensive data are summarized on ^{238}Pu and ^{239}Pu in dogs, and limited data are presented on the tissue distribution and pathological effects of ^{244}Cm, ^{241}Am, and ^{253}Es in dogs and other animals. (CH)

16858 EFFECT AND STORAGE OF GOLD IN THE EXPERIMENTAL FORMALIN ARTHRITIS OF RATS. Schoerg, G. 16 Feb 1971. 54p. (In German). INIS.

8 Tabs.; 71 refs. Available from the library of the Erlangen–Nuernberg Univ.

The effect of gold on formalin arthritis in rats and the content of ^{181}Au in the joints were studied. The changes in the joints of untreated animals could be seen for a period of over 70 days on the average, whereas in animals simultaneously treated with gold, complete disappearance of arthroses was observed after 25 days and, after pre-treatment for 14 days, arthroses were found to disappear after 17 days. Another effect observed is that the course of the disease was less severe since the strongest joint swelling found in untreated animals was 3.58 mm on the average, as compared to 1.37 mm in simultaneously treated and 0.72 mm in pre-treated animals. Experiments using ^{181}Au showed a correlation between content of β-emitting gold and observable degree of arthritis. Six series of experiments comprising 12 animals each were carried out. The results were verified by statistical evaluations. The conclusion drawn from the results, that gold suppresses the inflammatory symptoms by blocking the cells of the R.H.S., is discussed. (GE)

Nuclide Kinetics and Toxicology

Man

Refer also to abstracts 16524, 16527, 16952, and 16954.

16859 (BNWL-SA-5230) BIOMEDICAL ASPECTS OF PLUTONIUM. Bair, W. J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-1830. 38p. Dep. NTIS $5.00.

Data on the pathological effects of inhaled Pu aerosols in experimental animals are reviewed relative to the maximum permissible lung burden for personnel. An important consideration in evaluating the potential health effects of Pu is the availability of effective countermeasures following Pu exposures. Since no acceptable therapy exists for radiation exposures, the only really effective countermeasure for inhaled Pu would be the removal of the Pu from the body. Inhaled insoluble Pu is not effectively mobilized by a wide variety of agents which have been tested. A chelating agent, diethylenetriaminepentaacetic acid (DTPA), has had wide application for treating persons occupationally exposed to Pu. It reduces the liver burden and, to a lesser extent, the bone burden causing an increased urinary excretion of Pu. However, it is not effective in removing insoluble Pu from lung or lymph nodes. Therefore, it must be recognized that there is no truly effective countermeasure for Pu contamination, and that for all practical purposes all Pu deposited in the body will remain there until removed by natural processes, most of which are very slow. The development of therapeutic procedures for removing Pu from the body are high priority research projects in several laboratories. (CH)

16860 (IRI-190-73-01) RADIATION SAFETY ASPECTS OF SOME SORTS OF GLASS CONTAINING THORIUM. Rasmussen, C. E.; Weber, J.; Zeijlstra, F. (Interuniversitair Reactor Instituut, Delft (Netherlands)). Jan 1973. 17p. (In Dutch). INIS.

The radiation level (dose rate) as well as the removable radioactive surface contamination of some samples of thorium-containing optical glass (manufacture Schott, types LaSF 1 and BaSF 3) were measured, while at the same time the thorium content was determined by measuring the gamma radiation. With reference to the results, an evaluation is given of the radiation hazard connected to the handling and preparation of this glass. Supplementary measurements of the emery concentration in the air during a manipulation point out the necessity of suitable ventilation. However, no thorium contamination was found with four exposed glassworkers when they were examined with a whole-body counter. (INIS)

16861 (WASH-1359, pp 231-269) BIOMEDICAL EFFECTS OF PLUTONIUM ON HUMANS. Burr, W. W. Jr. (Atomic Energy Commission, Washington, DC); Richmond, C. R. Dec 1974.

In plutonium and other transuranium elements.

Although considerable data exists concerning the biological effects of Pu on experimental animals, comparatively little information is available regarding the effects of Pu and other actinide elements on man. However, despite its limited availability, the human data is regarded as highly relevant since it provides a check on the metabolic behavior of the actinide elements in man as compared to experimental animals, and the human observations will, in the course of time, provide an improved basis for the guidelines and standards under which the industry operates. The available data make us confident that present exposure standards are not grossly inadequate and that the experimental animal work can be accepted as relevant to the human situation. However, the human data are far too limited at this time to permit more specific conclusions to be drawn from them with respect to exposure limits. Those individuals who have been exposed to and/or retained plutonium for the longest periods of time are of particular interest. Data available on the biological effects of Pu on man, including personnel, human populations, and patients given tracer doses are reviewed. Control of industrial hazards of ^{238}Pu processing is based upon the premise that personnel exposure should be as low as practicable not because the maximum permissible body burden is a level which would do harm but because it is sound industrial medical and health protection practice. The lack of demonstrable biological effects of Pu in man is reassuring and represents presumptive evidence that the standards are not grossly inadequate. (CH)

16862 (WASH-1359, pp 271-289) IMPLICATIONS WITH RESPECT TO PROTECTION CRITERIA [FOR PLUTONIUM AND OTHER TRANSURANIC ELEMENTS IN ENVIRONMENT]. Thompson, R. C. (Battelle-Pacific Northwest Labs., Richland, WA). Dec 1974.

In plutonium and other transuranium elements.

Data are reviewed from studies on the biological effects of Pu in experimental animals that show that lifetime doses of 300 rems to lung or 1500 rems α particles to bone tissues result in a low, but significant, incidence of malignant tumors. Some occupational exposures approach, or even exceed, the minimum levels that have produced effects in animals, but most occupational exposures are much lower, and the exposures of the general population from fallout Pu have been very much lower, and essentially there is no data on the effects of Pu in man. The problems involved in the extrapolation of data on rats, mice, dogs, and baboons to effects on man are discussed. It is pointed out that different criteria should be used in establishing standards for the Pu exposure of personnel, where inhalation is the principal route of uptake, and the general population, where migration through food chains leads to uptake. The differences in the cost-benefits of the exposure of the two groups are also considered. It is concluded that the criteria of exposure to amounts as low as practicable should be used for both groups, since no arbitrary dose levels are possible where environmental effects are unmeasurable. Radiation protection criteria for Pu, which has been extensively studied over a 30-year period, can also be applied to other transuranic elements in the environment in the absence of specific data on their biological effects. (CH)

16863 TECHNETIUM-99M-PYROPHOSPHATE KINETICS AND IMAGING IN METABOLIC BONE DISEASE. Rosenthall, L.; Kaye, M. (Montreal General Hospital). J. Nucl. Med.; 16: No. 1, 33-39(Jan 1975).

A study was undertaken to investigate the behavior of ^{99m}Tc-Sn-pyrophosphate complex in metabolic bone disease. Of clinical importance was the generalized increased periarticular bone accumulation of the radiopharmaceutical in osteomalacia and in combined osteomalacia and osteitis fibrosa as found in patients with chronic renal failure. The pattern in primary hyperparathyroidism was variable. There was no correlation between the initial rates of accumulation of the radiophosphate complex or its bone to soft-tissue uptake ratio at 5 hr when compared with the degree of osteomalacia and osteitis fibrosa. It is postulated that the ^{99m}Tc-Sn-pyrophosphate complex has a greater affinity for immature collagen than the crystal surface. (auth)

16864 ALPHA CONTAMINATION OF THE SKIN: DOSE AND LET DISTRIBUTION AT DEPTHS CORRESPONDING TO THE EPIDERMAL THICKNESS OF SKIN. Madhvanath, U.; Murthy, M. S. S.; Vishwakarma, R. R.; Subrahmanyam, P.; Das, G. C. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 27: No. 5, 469-474(Nov 1974).

Recently it has been reported that the thickness of the epidermal layer of skin can be as low as 2 to 4 mg/cm^2 in certain parts of the body (Harvey, J. R. Health Phys.; 21: 866 (1971). Whitton, J. T. CEGB Report RD/B/R 1934 (1971). Whitton, J. T. Health Phys.; 24: 1 (1973)). In these areas, α contamination could result in the irradiation of basal layer cells. In order to evaluate the associated hazard, the energy distribution and dose of α particles from ^{210}Po and ^{242}Cm were measured at various depths. By computing the LET distribution, the Quality Factor ($\overline{QF}$) for α irradiation of basal cells was calculated to be 20. If an average epidermal thickness of 4 mg/cm^2 is accepted for radiation protection purposes (Whitton, 1973), contamination by α particles of energy 5.7 MeV and above can result in the irradiation of basal layer cells. For the current permissible skin contamination value of 10^{-5} μCi/cm^2, the dose rate at this depth from ^{242}Cm (6.11 MeV) is about 45 mrem/hr. Thus the dose to the skin becomes the limiting factor for arriving at the permissible skin contamination. Hence, it is desirable to lower the contamination level for energetic α particles. (auth)

16865 LONG-TERM RETENTION OF SYSTEMIC PROTACTINIUM-231 AND ACTINIUM-227. Newton, D.; Brown, D. A. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Health Phys.; 27: No. 5, 459-467(Nov 1974).

The behavior of ^{231}Pa and ^{227}Ac in a man who acquired systemic burdens of these nuclides via a puncture wound was studied over a period of 9 yr. From body radioactivity measurements and excretion analysis it was concluded that 70 to 80% of the ^{231}Pa and approximately 90% of the ^{227}Ac translocated from the wound are being retained almost indefinitely, with biological half-lives of 70 to 125 and ~125 yr, respectively. Distribution studies suggested that 3 yr after the intake the activity was principally deposited in bone, with some involvement of liver, but after 9 yr the contamination appeared to be almost exclusively skeletal. (auth)

Animals

Refer also to abstracts 16126, 16537, 16539, 16800, 16846–16848, 16852, 16854, 16855, 16947, and 16987.

16866 (AEC-tr-7590) DISTRIBUTION, BIOLOGICAL EFFECTS, AND ACCELERATED EXCRETION OF RADIOACTIVE ISOTOPES. Moskalev, Yu. I. (ed.). Dec 1974. Translation of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964. 411p. Dep. NTIS $10.60.

Separate abstracts were prepared for the 45 articles in this publication. This collection of articles was announced in NSA, volume 19, abstract number 3884. (HLW)

For abstracts of individual papers see: 16537, 16846–16856, and 16867–16899.

16867 (AEC-tr-7590, pp 5-11) DISTRIBUTION OF STRONTIUM-90 IN THE RAT ORGANISM FOLLOWING INTRATRACHEAL ADMINISTRATION. Korolev, G. K. Dec 1974. Translated from pp 9-14 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Following intratracheal administration of ^{90}Sr, rats were killed after 5 and 30 min, 1, 5, and 12 hrs, and 1, 3, 7, 10, 15, 30, and 60 days. Data are tabulated for ^{90}Sr content expressed as percent of given dose and as μCi/g in the lungs, blood, skeleton, gastrointestinal tract, liver, kidneys, spleen, and muscles. (HLW)

16868 (AEC-tr-7590, pp 12-20) DISTRIBUTION OF CERIUM-144 IN THE RAT ORGANISM FOLLOWING INTRATRACHEAL ADMINISTRATION. Korolev, G. K. Dec 1974. Translated from pp 15-22 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Following intratracheal administration of ^{144}Ce, rats were killed after 5 and 30 min, 1, 5, and 12 hrs, and 1, 3, 6, 10, 30 and 60 days. Data are tabulated for ^{144}Ce content expressed as percent of given dose and as μCi/g in the lungs, blood, skeleton, gastrointestinal tract, liver, kidneys, spleen, muscles, heart, and skin. (HLW)

16869 (AEC-tr-7590, pp 21-26) DISTRIBUTION OF YTTRIUM-90, ZIRCONIUM-95, AND NIOBIUM-95 IN THE RAT ORGANISM FOLLOWING INHALATION. Moskalev, Yu. I.; Semenov, D. I.; Buldakov, L. A. Dec 1974. Translated from pp 23-28 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Following inhalation of ^{90}Y, ^{95}Zr, and ^{95}Nb, radioactivity was measured in the blood, liver, kidneys, spleen, gastrointestinal tract, lungs, trachea, head, skeleton, and skin after 15 min, 1 and 6 hrs, and 1, 4, 8, 16, and 36 days. The tabulated data are expressed as percent of given dose. (HLW)

16870 (AEC-tr-7590, pp 27-33) EXPERIMENTS DEALING WITH DISTRIBUTION OF THORIUM-X, A RADIUM ISOTOPE.

Moskalev, Yu. I. Dec 1974. Translated from pp 29-34 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Following intravenous and intramuscular administration of thorium-X, radioactivity was measured at intervals in feces and urine. In other experiments radioactivity was measured at intervals in the blood, liver, kidneys, spleen, lungs, thyroid, lymph nodes, adrenals, salivary glands, gastrointestinal mucosa, bone marrow, skeleton, testes, and muscles. Tissue distribution was related to age of the animals. (HLW)

16871 (AEC-tr-7590, pp 34-41) BEHAVIOR OF A CITRATE COMPLEX OF PLUTONIUM-239 IN THE RAT ORGANISM FOLLOWING INHALATION THEREOF. Lyubchanskii, E. R. Dec 1974. Translated from pp 35-41 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Following inhalation of a citrate complex of ^{239}Pu, rats were killed at intervals of 6 hrs, 1, 8, 16, 32, 64, 128, and 256 days. Data are tabulated for ^{239}Pu levels in the gastrointestinal tract, lungs, skeleton, liver, muscles, and blood. Resorption and kinetics of ^{239}Pu in the various organs are discussed. (HLW)

16872 (AEC-tr-7590, pp 42-62) LEVELS AND MICRODISTRIBUTION OF PLUTONIUM-239 IN THE RAT LUNGS AND LIVER, AND MORPHOLOGICAL CHANGES IN THESE ORGANS FOLLOWING INTRATRACHEAL ADMINISTRATION OF THE ISOTOPE. Erokhin, R. A.; Koshurnikova, N. A.; Lyubchanskii, E. R.; Nifatov, A. P.; Reshetov, G. N. Dec 1974. Translated from pp 42-61 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Rats were given ^{239}Pu intratracheally in the form of a nitrate salt, $Pu(NO_3)_4$ and in the form of sodium plutonyl triacetate, $NaPuO_2(CH_3COO)_3$. At intervals up to 6 months the tissue dose was measured in the lungs and liver and results are tabulated. The plutonium content of the lungs was 5 to 10 times higher after administration of nitrate than after triacetate. Plutonium was eliminated faster following administration in the form of triacetate. Accumulation of plutonium in the liver was slower after administration of nitrate than of triacetate. Histological changes in the lungs were related to microdistribution of plutonium and developed primarily in foci of accumulation of the radioisotope. Significant morphological changes were not demonstrated in the liver. (HLW)

16873 (AEC-tr-7590, pp 63-72) EXPERIMENTS DEALING WITH DISTRIBUTION OF ANTIMONY-124 AND TELLURIUM-127. Moskalev, Yu. I. Dec 1974. Translated from pp 62-70 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Antimony-124 and ^{127}Te were administered to rats intravenously and orally. Excretion of ^{124}Sb in the urine and feces was measured and results are tabulated. The animals were killed at intervals and levels of ^{124}Sb and ^{127}Te were determined in the blood, liver, spleen, kidneys, lungs, skin, muscles, and skeleton. Results are tabulated. (HLW)

16874 (AEC-tr-7590, pp 73-80) DISTINCTIONS OF MOLYBDENUM-99 DISTRIBUTION IN THE ANIMAL ORGANISM, AS COMPARED TO THE DISTRIBUTION OF PHOSPHORUS-32. Borisov, V. P. Dec 1974. Translated from pp 71-77 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Rats were given ^{99}Mo and ^{32}P by mouth and were killed at intervals up to 10 days. Levels of the isotopes were determined in the blood, skin, skeleton, muscles, liver, kidneys, spleen, and brain and results are tabulated. (HLW)

16875 (AEC-tr-7590, pp 81-86) EXPERIMENTS DEALING WITH DISTRIBUTION OF TIN-113. Moskalev, Yu. I. Dec 1974. Translated from pp 78-82 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Rats were given ^{113}Sn intravenously, intraperitoneally, and orally. Excretion in the urine and feces was determined at intervals up to 4 days and results are tabulated. In other experiments rats were killed at intervals and levels of ^{113}Sn were determined in the blood, liver, kidneys, spleen, lungs, muscles, skin, skeleton, stomach, intestines, and testes. Results are tabulated. (HLW)

16876 (AEC-tr-7590, pp 87-98) DISTRIBUTION OF A MIXTURE OF CERIUM-144 AND STRONTIUM-89, -90 RADIOISOTOPES. Moskalev, Yu. I. Dec 1974. Translated from pp 83-93 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

A mixture of ^{144}Ce, ^{89}Sr, and ^{90}Sr was given to rats intravenously and orally. The rats were killed at intervals and levels of the isotopes were determined in the liver, spleen, kidneys, lungs, heart, skin, muscles, brain, testes, skeleton, blood, adrenal glands, salivary glands, thyroid, ovaries, and gastrointestinal tract. Results are tabulated. Most of the radioactivity was retained in the skeleton and liver. (HLW)

16877 (AEC-tr-7590, pp 99-102) CHANGES IN CORRELATION BETWEEN ISOTOPES IN A MIXTURE OF PRODUCTS OF URANIUM FISSION WITH RESORPTION THEREOF FROM THE DIGESTIVE TRACT. Borisov, V. P. Dec 1974. Translated from pp 94-97 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

A solution of fission products containing ^{144}Ce, ^{89}Sr, ^{90}Sr, ^{90}Y, and ^{95}Zr was administered to rats through a stomach tube. Distribution of the isotopes in the bones, liver, muscles, and skin is shown by means of tables. Ninety to 96% of the isotopes of Sr, Y, and Zr were concentrated in bone tissues. (HLW)

16878 (AEC-tr-7590, pp 103-111) STRONTIUM-90 LEVELS IN THE RAT ORGANISM WITH CHRONIC INTAKE BY MOUTH. Buldakov, L. A.; Erokhin, R. A. Dec 1974. Translated from pp 98-105 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Rats of 3 age groups were given drinking water containing ^{90}Sr and ^{90}Y for 86 weeks. Rats were killed at intervals and levels of ^{90}Sr were determined in the stomach, intestines, muscles, liver, skeleton, and kidneys. Most of the radioactivity was in the skeleton. (HLW)

16879 (AEC-tr-7590, pp 112-118) DISTRIBUTION OF STRONTIUM-90 IN THE DOG SKELETON AS RELATED TO CHRONIC INTAKE. Yartsev, E. I.; Burykina, L. N. Dec 1974. Translated from pp 106-111 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Dogs were given ^{90}Sr with their food 6 times a week for a period of 17 months. The animals were killed at intervals and the ^{90}Sr content was determined in the pelvic bones, skull, vertebrae, ribs, sternum, femur, and teeth. Results are tabulated. (HLW)

16880 (AEC-tr-7590, pp 119-123) ACCUMULATION OF STRONTIUM-90 IN THE DOG SKELETON WITH CHRONIC INTAKE. Kushneva, V. S. Dec 1974. Translated from pp 112-116 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Strontium-90 was administered to dogs with food for a period of 3 years. Incorporation of ^{90}Sr in the skeleton was determined by radiometric analysis of caudal vertebrae amputated at various intervals after the beginning of intake. Tables are presented to show dose rates, absorbed tissue dose, and CDA (coefficient of differential accumulation). At the end of 3 years, two dogs were killed and the ^{90}Sr content was determined in all organs and bone samples. (HLW)

16881 (AEC-tr-7590, pp 124-130) BEHAVIOR OF PLUTONIUM-239 CITRATE IN THE RAT ORGANISM FOLLOWING SINGLE AND REPEATED INTRAPERITONEAL ADMINISTRATION. Lyubchanskii, E. R. Dec 1974. Translated from pp 117-123 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Five days after single intraperitoneal administration of ^{239}Pu citrate to rats, the liver demonstrated 13.8 ± 0.84%; the femur, 3.72 ± 0.16%; the scapula, 0.81 ± 0.05%; and the muscles, 2.11 ± 0.16% of the given dose. For 85% of the isotope, the biological half-life is 7 days and for 15%, 125 days, for elimination from the liver; with regard to the spleen, 35% is excreted with a half-life of 31 days and 65%, 600 days. The biological half-life of ^{239}Pu elimination from the femur is 840 days; from the scapula, 700 days; and for muscles, 108 days. The age of the rats affects the magnitude of deposition and excretion of ^{239}Pu: five days after administration of the isotope, there is 25 and 20% less retention in the femur and scapula, respectively, of old rats (18 months old) than in young ones (3 months old); the magnitude of excretion is 100% greater in old rats. When administered the 2nd time, the behavior of ^{239}Pu is different from its behavior following single administration; it is characterized by gradual decrease in deposition of the isotope in the femur and scapula and increased excretion in feces. The pattern of ^{239}Pu deposition in the liver and muscles is undulant. (auth)

16882 (AEC-tr-7590, pp 131-138) PASSAGE OF STRONTIUM-90 FROM CANINE MOTHER TO OFFSPRING WITH CHRONIC INTAKE THEREOF. Burykina, L. N.; Parfenov, Yu. D. Dec 1974. Translated from pp 124-130 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

With continuous intake of ^{90}Sr by bitches throughout the gestation and lactation period, the concentration of strontium in the puppy skeleton is 100% higher than the concentration in the maternal skeleton. The maximum concentration of ^{90}Sr in puppies during postembryonic development is 4 times higher than the maximum concentration in the fetus. The experimental results indicate that offspring born to and suckled by mothers to whom this isotope was continuously given with food accumulates rather large quantities of radioactivity which causes concern as to their future fate. (auth)

16883 (AEC-tr-7590, pp 139-144) ACCUMULATION AND DISTRIBUTION OF STRONTIUM-90 IN PIGS WITH PROLONGED INTAKE THEREOF. Annenkov, B. N.; Chukhin, S. G.; Bakhareva, Z. A. Dec 1974. Translated from pp 131-135 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

When pigs weighing 20 to 180 kg are given radiostrontium with their feed, deposition thereof in the organism constitutes about 4% of the given dosage. There is uneven distribution of radiostrontium: 93.3 to 96.9% of the ^{90}Sr demonstrated in the organism is retained in the skeleton and the remainder in the soft tissues and organs. Of the 2 rare earth elements (calcium and ^{90}Sr), there is preferential assimilation of calcium in the swine organism. The coefficient of discrimination of ^{90}Sr in relation to calcium in the feedbone link constitutes 0.17 to 0.33. There is rapid decrease in radiostrontium level in the organism after administration thereof is stopped. The effective half life of ^{90}Sr is 112 ± 26 days. (auth)

16884 (AEC-tr-7590, pp 145-151) ACCUMULATION OF STRONTIUM IN THE CALF SKELETON. Buldakov, L. A.; Burov, N. I. Dec 1974. Translated from pp 136-141 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

The distribution of ^{90}Sr in the calf skeleton between the time of birth and the age of 9 months is characterized by nonuniform accumulation of the isotope in different bones; there is a 3.5 to 10-fold difference between maximum and minimum concentration of strontium in different bones. At 1.5 years of age, the differences are no more than 3-fold. Strontium retention in the fetal skeleton during the last 120 days of pregnancy is unrelated to the quantity of isotopes within the range of the doses studied that have penetrated into the cow's stomach, and it ranges from 0.52 to 2.25%, the mean being 1.41%. In growing calves, strontium retention in the skeleton decreases from 67.5% in the first month of life to 12.85% at the age of 18 months. Between the ages of 9 and 18 months, the calf skeleton retains 3.64% of the strontium that has penetrated into the stomach. The multiplicity of ^{90}Sr accumulation in the skeleton of neonate calves constitutes a mean of 1.69, with a range of 0.63 to 2.71. The maximum multiplicity of accumulation, 100.5 to 121.0, was demonstrated in the 9th month of life and thereafter it diminishes to 70 to 73.2 by the time the calf is 18 months old. During the second half of pregnancy, the coefficient of strontium discrimination in relation to calcium in the maternal feed–skeleton system constitutes 0.259. During the first 9 months of life there is virtually no strontium discrimination in the feed–skeleton chain; the coefficient of discrimination ranges from 0.83 to 1.05. Between the ages of 9 and 18 months, the coefficient of discrimination of strontium in the feed–skeleton system drops to 0.204. (auth)

16885 (AEC-tr-7590, pp 152-157) SOME DATA ON ACCUMULATION OF STRONTIUM-90 IN CATTLE, AT THE EMBRYONIC AND POSTEMBRYONIC STAGES OF DEVELOPMENT. Annenkov, B. N.; Bakhareva, Z. A. Dec 1974. Translated from pp 142-146 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

When cows are given ^{90}Sr with their fodder during the last 3rd of the gestation period, 0.50 to 1.24% of the radiostrontium given to the mothers passes into the fetus. Deposition of radioactive strontium in calves 2 to 3 months of age constitutes about 60% and it drops to 30 to 40% at 4 to 6 months of age. In the cow organism, 0.9 to 1.6% of ^{90}Sr ingested with hay is retained. Addition of a mineral supplement ($CaCO_3$) to the diet of cattle, which provides for intake of excess calcium diminishes deposition of radiostrontium in the organism. There is the same type of distribution of ^{90}Sr in different age groups of cattle. Most of the radiostrontium (92 to 99%) is retained in the skeleton; 1 to 8% of the total radiostrontium demonstrated in the animal organism is retained in soft tissues and organs. (auth)

16886 (AEC-tr-7590, pp 158-165) PENETRATION OF THE OVINE PLACENTAL BARRIER BY STRONTIUM-90. Burov, N. I.; Buldakov, L. A. Dec 1974. Translated from pp 147-153 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

With single intravenous and oral administration of the isotope to ewes, the magnitude of ^{90}Sr passage into the fetus is related to the stage of pregnancy: the more advanced the stage the greater the quantity of strontium that passes into the fetal organism. With pregnancies of 30, 90, 120, 136 and 152 days, the following quantities of strontium are deposited in the fetal skeleton: 0.207%, 1.23%, 6.72%, 9.41% and 12.13% of the strontium injected in the blood of the ewe. After single intake by mouth 500 to 510, and 50 to 100 days before gestation and with gestation at the 120th, 136th and 152nd day, the deposition in the fetal skeleton constitutes 0.0144 ± 0.0029%, 0.082 ± 0.003%, 0.876%, 1.10%, and 0.509% of the given dose, respectively. The quantity of ^{90}Sr that passes from the maternal to the fetal organism throughout the gestation period, in the case of chronic intake of this isotope, is related to the duration of the experiment: the longer the period during which the ewe is given strontium before the next pregnancy, the larger the quantity of isotope penetrates into the fetus. During the first (8 months), 2nd (15 to 16 months) and 3rd pregnancies (24 to 25 months after the start of isotope administration), 34.47 ± 4%, 110.6 ± 17% and 199.6 ± 22%, respectively, of the daily strontium dosage given penetrate from the mother into the fetal skeleton. The distribution of strontium in the lamb skeleton is not uniform and it is related to the stage of pregnancy. With chronic administration of the isotope, when it is given before the pregnancy or at the early stages thereof, the highest concentrations of the isotope are demonstrable in the cranial bones, mandible and diaphysis; when the isotope is given at later stages the highest levels are found in the metaphysial parts of the long bones. (auth)

16887 (AEC-tr-7590, pp 173-177) DISTRIBUTION OF LEAD (THORIUM B) FOLLOWING INJECTION INTO ARTERIES AND VEINS. Moskalev, Yu. I. Dec 1974. Translated from pp 161-164 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Thorium B was injected into the blood stream of rabbits and rats. Ten to 18 times more radioactivity was found in bone tissues, bone marrow, and muscles following intraarterial injection than following subcutaneous or intravenous injection. Following injection into the mesenteric vein, 3.3 times more ^{212}Pb was found in the rat liver than following injection into the caudal vein. (HLW)

16888 (AEC-tr-7590, pp 178-193) METABOLISM AND BIOLOGICAL EFFECTS OF CESIUM-137 ON SHEEP. Buldakov, L. A. Dec 1974. Translated from pp 167-182 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Following intake by mouth in a dose of 2.2 μCi/day, ^{137}Cs was uniformly distributed in the internal organs of sheep for 105 days. Higher concentrations were observed in muscles and skin and minimal concentrations in bones and bone marrow. During the period of chronic intake by mouth, ^{137}Cs excretion in the feces constituted 11.04%; in the urine, 9.16%; and in the milk, 2.02% of the daily intake per kg of weight. Cesium was transmitted from mother to offspring primarily with milk during the first month of life. (HLW)

16889 (AEC-tr-7590, pp 226-229) CHANGES IN BLOOD COMPOSITION OF PREGNANT ANIMALS IN THE PRESENCE OF STRONTIUM-90 IN THE ORGANISM. Petrovich, I. K. Dec 1974. Translated from pp 213-216 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Strontium-90, in a dose of 0.2 μCi/kg, elicits an acute form of radiation sickness in dogs. Following the acute phase of radiation sickness, males and nonpregnant females show recovery of hemopoiesis. In pregnant animals, the recovery processes are interrupted and in the second half of the gestation period there is a second decline in number of erythrocytes, thrombocytes and leukocytes. Evidently, the second decrease in number of erythrocytes, leukocytes and thrombocytes could be attributed to involvement in metabolic processes of ^{90}Sr transferred into the fetal skeleton along with calcium salts. (auth)

16890 (AEC-tr-7590, pp 303-311) EVALUATION OF SOME IMMEDIATE MEASURES AGAINST INJURY BY RADIOACTIVE SUBSTANCES. Borisov, V. P.; Krivchenkova, R. S. Dec 1974. Translated from pp 291-298 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

In the event radioactive elements penetrate into the stomach of rats the effects of several drugs may change considerably, depending on the mode of their administration: simultaneous intake of uranium and sodium bicarbonate in the gastrointestinal tract, of uranium and heavy metal antidote, cerium and complexons increases deposition of the radioactive elements in tissues and organs. Activated charcoal (carbolen) did not prevent absorption of the radioactive substances tested; consequently, there is no justification for recommending its use for this purpose. A study of the effectiveness of complexons when ^{144}Ce has penetrated into the digestive tract revealed that trisodium calcium salt of diethyleneaminopentoacetic acid (Na_3Ca DTPA) presents a significant decrease of its therapeutic effect, as compared to its effectiveness when ^{144}Ce is given intraperitoneally. There must be strict contraindications against the use of complexons for gastric lavage or decontamination of the mouth, since experiments proved that with penetration of complexons in the stomach, in cases of oral ^{144}Ce poisoning, there is a sharp increase in level of deposition of the radioisotope in the liver and bones. A beneficial response (decreased deposition in the kidneys) was obtained in experiments involving administration of ^{238}U to animals, with the use of phosphates. It was demonstrated that antidotum metallorum and "dry hydrogen sulfide" (hydroquinone sulfhydrate) are effective against polonium in the stomach, barium sulfate ($BaSO_4$) is effective against strontium 90 poisoning, and fluorexon against ^{144}Ce lesions. Fluorexon (N, N-di-carboxymethyl aminomethylfluorescein) diminished deposition of ^{144}Ce in the skeleton and liver, concurrently. (auth)

16891 (AEC-tr-7590, pp 312-325) SOME DATA ON EXPERIMENTAL THERAPY OF RABBITS GIVEN TRITIUM OXIDE. Zhuravlev, V. F. Dec 1974. Translated from pp 299-310 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Administration of tritium oxide to rabbits, by mouth, in a dosage of 0.4 Ci/kg elicits severe radiation sickness. Diuretin and a water load accelerate elimination of tritium oxide from the rabbit organism. KO-2 has a stimulating effect on hemopoietic organs (it increases the number of erythrocytes and leukocytes). Administration of combined therapy elicits survival of most experimental animals (17 out of 20). The survival time of the three treated animals was 1.5-2 times longer than in controls. The clinical manifestations of radiation sickness were much less marked in treated animals and there was earlier restoration of disturbances referable to different organs and systems. (auth)

16892 (AEC-tr-7590, pp 326-330) EFFECT OF DIETARY CALCIUM ON METABOLISM OF STRONTIUM-90 IN THE FODDER–MILK LINK, IN COWS. Buldakov, L. A.; Burov, N. I.; Ukhanova, V. A. Dec 1974. Translated from pp 311-316 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

During the summer, transfer of ^{90}Sr from green fodder into milk is related to the calcium level in the diet and magnitude of daily milk yield. When the daily milk yield is the same from cows on a diet with low calcium level (oats–30 grams calcium per day) and with high calcium content (vetch–70 grams calcium per day), 0.27 and 0.12% of the strontium dosage given daily is excreted per liter of milk, and 2.78 and 1.15%, respectively, in the daily yield. When there are significant differences in milk yield, ^{90}Sr excretion in milk per liter is somewhat higher in the cows with low yield (0.12–0.27%) than in highly productive animals (0.10–0.23% of the daily given dose). When converted per daily yield, ^{90}Sr excretion in milk is much higher (1.96–4.95%) in highly productive cows than in those with a low output (1.164–2.78%). In the summertime, the ^{90}Sr discrimination coefficient in the fodder–milk link constitutes 0.080 and 0.088, and it is unrelated to either the magnitude of daily milk yield or quantity of calcium in the fodder (within the range of studied fluctuations of calcium in the diet–29.82 to 76.07 grams per day). (auth)

16893 (AEC-tr-7590, pp 331-345) EFFECTS OF SOME FOOD COMPONENTS (CALCIUM, MAGNESIUM, PROTEIN, FAT) ON ACCUMULATION OF STRONTIUM-90 IN ANIMALS. Annenkov, B. N. Dec 1974. Translated from pp 316-328 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

There is a 2.8 to 3-fold decrease in deposition of ^{90}Sr in the skeleton of young rats and rabbits and 2.8 to 3-fold decrease, in adult animals with an increase in calcium content from 0.25 to 1.5% in the diet of rats and rabbits, and from 0.35 to 3.35% in the diet of fowl. With increase in calcium content of the diet of growing and adult chickens, there is a 1.6 and 1.8-fold decrease, respectively, in accumulation of radiostrontium in the skeleton. Decreased deposition of ^{90}Sr is observed when calcium is added to diets containing different quantities of phosphorus, magnesium, fat and protein. The addition of calcium demonstrates a distinct protective effect, in a diet with a low (0.25 to 0.3%) level of this element, whereas addition of calcium to diets with normal (1.2 to 1.25%) levels of calcium is either ineffective, or else the response is minimal. The protective action of calcium compounds against ^{90}Sr is related not only to the ion of calcium but also the anion to which it is linked. The calcium compounds studied can be arranged in the following order of diminishing effectiveness: $Ca_3(PO_4)_2 \rightarrow CaO, Ca(COO)_2 \rightarrow CaCO_3 \rightarrow Ca(C_3H_5O_3)_2$. Of the tested magnesium compounds (MgO, $MgCl_2$, $MgCO_3$, $MgSO_4$), the best protective effect against deposition of ^{90}Sr was obtained with magnesium oxide and chloride. With administration of magnesium oxide into the digestive tract of rats, rabbits and dogs, at the rate of 250–400 mg/kg (as converted to Mg^{2+}), there is one-third less deposition of ^{90}Sr in the skeleton. The effects of fats on ^{90}Sr metabolism are related to the type of fat. Vegetable oil increases 1.4 to 2.1-fold deposition of this radioisotope in the skeleton, where as fats of animal origin, on the contrary, diminish retention of ^{90}Sr by 1.2 to 1.4 times. The changes in accumulation of ^{90}Sr in the skeleton with addition of 10 to 30% fat to the diet are unrelated to the quantity of fat added within the range indicated. A change in concentration of protein in the diet, in the direction of a decrease (from 20 to 11%) or increase (from 20 to 30%) elicits a 1.4 to 1.5-fold decrease in retention of ^{90}Sr in the skeleton of young rats and 1.2 to 2-fold decrease in the skeleton of adult rats. The changes in accumulation of ^{90}Sr in the skeleton of animals with changes in calcium, phosphorus, magnesium, fat or protein content in the diet are apparently related essentially to a change in absorption of the radioisotope in the digective tract. (auth)

16894 (AEC-tr-7590, pp 346-350) EFFECT OF HYPOCALCEMIA AND SUBCUTANEOUS INFLAMMATION ON LEVEL OF RADIOACTIVE STRONTIUM IN THE SKELETON. Razumovskii, N. O.; Torchinskaya, O. L. Dec 1974. Translated from pp 329-333 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Hypocalcemia, induced by intravenous and intraperitoneal administration of NaEDTA into rabbits at the early stages following injection of ^{89}Sr, elicits increased deposition of this isotope in bone tissue. With development of hypocalcemia after 2 weeks, there is some decline of skeletal radioactive strontium. Subcutaneous drip infusion of NaEDTA, as well as administration of turpentine, are associated with inflammation at the site of injection and drop of radioactivity level of bones; the latter is apparently related to the signs of inflammation. (auth)

16895 (AEC-tr-7590, pp 351-355) EFFECTS OF COMPLEXING AGENTS ON LEVEL OF RADIOSTRONTIUM DEPOSITION IN BONES. Razumovskii, N. O.; Torchinskaya, O. L. Dec 1974. Translated from pp 334-337 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Strontium-89 was administered intraperitoneally and orally to rats. The following complexing agents were administered simultaneously or 1 hr before the ^{89}Sr: DTPA; EDTA; 7-nitro-5-sulfo acid-8-hydroxy-quinoline; and sodium salt of 7-(0-carboxyazophenyl)-5-sulfo acid-8-hydroxyquinoline. Three days later the animals were killed and radioactivity of the skeleton was determined. EDTA was the only agent that resulted in a lower deposition of ^{89}Sr. (HLW)

16896 (AEC-tr-7590, pp 356-360) PLUTONIUM REMOVAL IN RATS GIVEN SOME COMPLEXONS BY MOUTH. Belyaev, Yu. A. Dec 1974. Translated from pp 338-342 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Administration of EDTA and DCTA by mouth is ineffective, even at the early stages, with respect to removal of plutonium, not only from the skeleton but also from the liver. EDPA is effective only when given 2 or 6 hours after the plutonium injection. Multiple administration of EEDTA 1 day after administration of plutonium lowers the plutonium level in both the liver (1.6-fold decrease) and skeleton (65% of the control); when, however, it is given 30 days after plutonium, the effect is referable chiefly to the plutonium level in the liver (2-fold decrease). The best response is obtained with DTPA which diminishes plutonium content of the liver and skeleton regardless of time of administration. When this agent is given 30 days after plutonium, there is a 4.5-fold decrease in its level in the liver and a 1.6-fold decline in the skeleton (61% of the control). (auth)

16897 (AEC-tr-7590, pp 361-366) EFFECTIVENESS OF DIETHYLENETRIAMINEPENTAACETIC ACID FOLLOWING INTRATRACHEAL ADMINISTRATION OF PLUTONIUM. Belyaev, Yu. A.; Lemberg, V. K. Dec 1974. Translated from pp 343-347 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

The effectiveness of DTPA, with reference to removal of ^{239}Pu given to rats in the form of nitrate or carbonate complex intratracheally from the lungs, is negligible, even at the early stages of treatment. Intratracheal administration of DTPA is, however, somewhat more effective than intraperitoneal. Plutonium pentacarbonate of ammonium, when given intravenously is 80% (of given dose) retained in the liver. Mean excretion of ^{239}Pu in urine constitutes 0.1% and in feces, 12% (between the 1st and 7th days). Single intraperitoneal administration of DTPA (24 hours after intravenous administration of a plutonium carbonate complex) lowers the ^{239}Pu content of the liver by 23% (as compared to the control). (auth)

16898 (AEC-tr-7590, pp 367-374) POSSIBILITY OF ADMINISTRATION OF COMPLEXONS BY MOUTH TO REMOVE RARE EARTH ELEMENTS (CERIUM-144) FROM THE ORGANISM. Torchinskaya, O. L.; Razumovskii, N. O. Dec 1974. Translated from pp 348-355 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

Complexons can be given by mouth to rats provided due consideration is given to the stability of the complex they form with the element involved, route of intake of the radioisotope, and time that has elapsed after administration of the radioisotope. DTPA, a compound that forms the most stable complex with cerium, can be given following administration of the radioisotope, either by mouth or parenterally, both at the early stages, when ^{144}Ce is in the gastrointestinal tract or circulating blood, and at a time when the radioisotope is already incorporated in tissues. DEETA should not be used at the early stages following ingestion of ^{144}Ce when the latter is in the gastrointestinal tract, since, in this case, there is increased accumulation of the radioisotope in organs. One or more days after intake of ^{144}Ce by mouth, DEETA may be administered by mouth. DEETA elicits a beneficial effect at the early and late stages following parenteral administration of the radioisotope. (auth)

16899 (AEC-tr-7590, pp 375-380) EFFECT OF N, N, N', N'-TETRAACETIC, 2,2'-DIAMINODIETHYLSULFIDE ON EXCRETION OF URANYL NITRATE AND COURSE OF URANIUM INTOXICATION IN RATS. Ivannikov, A. T.; Razbitnaya, L. M.; Smolin, D. D. Dec 1974. Translated from pp 356-360 of Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov, Meditsina, Moscow, 1964.

In distribution, biological effects, and accelerated excretion of radioactive isotopes.

DDSTA is an effective complexing agent for uranyl nitrate; it increases elimination of uranium from the organism when given at both the early stages after uranium and at the later stages, when deposition of uranium has already occurred. The complex compound of uranium and DDSTA is excreted in urine. The data pertaining to residual uranium level in the rat are indicative of a significant decrease in accumulation of uranium in the organism of treated animals, particularly in the skeleton, which is the chief reservoir of uranium. (auth)

16900 USE OF COMPUTERS FOR DYNAMIC RADIONUCLIDE STUDIES. Fried, J. (Sloan-Kettering Inst., New York). pp 263-310 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (ed.). New York; Academic Press, Inc. (1974).

Computer-aided simulation of radionuclide studies is discussed with regard to types of models, general methods for fitting of data to models, curve fitting, data smoothing and interpretation, and numerical integration. Fields of application include kinetics of bone-seeking nuclides, blood flow and organ function studies, and ferrokinetics. (HLW)

16901 TECHNETIUM-99m-PYROPHOSPHATE: STUDIES IN IN VIVO AND IN VITRO. Kaye, M.; Silverton, S.; Rosenthall, L. (Montreal General Hospital). J. Nucl. Med.; 16: No. 1, 40-45 (Jan 1975).

In rats with induced rickets, the uptake of $^{99m}TcO_4$ and ^{99m}Tc-pyrophosphate per gram of bone was increased as compared with weight-matched controls. However, the uptake of radioactive calcium and ^{32}P-pyrophosphate was similar in both rachitic and control animals, suggesting that the ^{99m}Tc label conferred specificity and favored the rachitic lesions. Employing the rat tibia in an in vitro system, $^{99m}TcO_4$ uptake was predominantly in the organic bone matrix; radioactive calcium, ^{32}P-pyrophosphate, or ^{14}C-diphosphonate uptake was mainly in the bone mineral; and ^{99m}Tc-pyrophosphate, ^{99m}Tc-diphosphonate, and ^{99m}Tc-polyphosphate were found in both mineral and organic phases. By removal of both mineral and polysaccharide and by using agents that altered the degree of collagen fibril cross-linking, evidence was obtained suggesting that $^{99m}TcO_4$ and ^{99m}Tc-pyrophosphate are preferentially bound by immature collagen. (auth)

16902 UPTAKE OF RADIOLABELED ESTRADIOL BY THE CANINE ADRENAL. Sturman, M. F.; Beierwaltes, W. H.; Ice, R. D.; Prakash, S. (Univ. of Michigan, Ann Arbor). J. Nucl. Med.; 16: No. 1, 77-79(Jan 1975).

Tritiated estradiol injected intravenously into 11 mongrel dogs sacrificed at 3, 7, 10, 17, and 60 min showed maximum uptake in the adrenal gland at 3 to 7 min. The concentration of radioactivity in the adrenal in percent dose per gram equaled that from ^{131}I-19-iodocholesterol. If a ^{131}I-estradiol could be synthesized that would concentrate similarly in the adrenal, it would offer the advantage of almost instantaneous imaging after the tracer injection and a lower radiation dose. (auth)

16903 DISTRIBUTION OF ^{99m}Tc–Sn DIPHOSPHONATE AND FREE ^{99m}Tc-PERTECHNETATE IN SELECTED SOFT AND HARD TISSUES. Silberstein, E. B.; Francis, M. D.; Tofe, A. J.; Slough, C. L. (Univ. of Cincinnati). J. Nucl. Med.; 16: No. 1, 58-61 (Jan 1975).

Because increased uptake of ^{99m}Tc-diphosphonate (ethane-hydroxy-1, 1-diphosphonate) occasionally occurs in the anterior neck region, the possible increased affinity of the diphosphonate bone-scanning agent for cartilage was investigated. In vivo scintigraphic studies and organ analyses from rats and rabbits injected with this bone scintigraphic agent were performed. Trachea-to-muscle uptake ratios were a high 45:1 in adult Sprague-Dawley rats and approached the femur-to-muscle ratio of 93:1. Technetium-99m-diphosphonate uptake was also increased, but to a lesser extent, in xiphoid cartilage, tendon, and ear cartilage; this was proportional to the calcium content of the organ. The thyroid showed a high affinity for free pertechnetate but not ^{99m}Tc-diphosphonate, providing further evidence that the increased neck uptake of this ^{99m}Tc-diphosphonate is due to tracheal, not thyroid activity. In addition, premedication of three patients with 200 mg of potassium-perchlorate did not block this neck uptake. Interpretation of scintigraphs performed with ^{99m}Tc-diphosphonate that show lesions in the cervical spine should take into account the potential for false-positive readings caused by this increased tracheal uptake. (auth)

16904 RELATIVE QUANTITY OF AIRBORNE PLUTONIUM DEPOSITED IN THE RESPIRATORY TRACT AND ON THE SKIN OF RATS. Craig, D. K.; Mahlum, D. D.; Klepper, E. L. (Battelle Pacific Northwest Labs., Richland, WA). Health Phys.; 27: No. 5, 475-479(Nov 1974).

In assessing the hazard of exposure to airborne plutonium, questions arise as to the relative importance of material deposited within the respiratory tract and on skin. To provide relevant deposition data, shaved rats were exposed to a ^{238}Pu(NO$_3$)$_4$ aerosol in a low-speed wind tunnel. Half were oriented with noses facing upstream, the other half with noses downstream. Samples of the airstream were taken during exposure to determine the aerosol concentration and its aerodynamic equivalent size distribution. Calculations of the quantity inhaled were made from the aerosol concentration, minute volume and exposure time; skin deposition was estimated from the aerosol deposition velocity, area of exposed skin and exposure time. Immediately after exposure, the rats were sacrificed, skinned and dissected and the plutonium activity on the skin compared to that in lungs, head, and intestines. Rats with their noses downstream inhaled only 66% as much as the upstream group. In both cases, about 40% of the inhaled material was in the lower respiratory tract, about 40% in the head and 20% in the intestines. Plutonium deposited on the skins of the two groups was almost identical, being 22 to 33% of the respiratory tract value. Measured values agreed with the calculated values within a factor of two. (auth)

16905 INFLUENCE OF INCREASED INTRACRANIAL PRESSURE ON THE CEREBRAL BLOOD FLOW OF THE DOG. Experimental Work by Using the Anger Camera and Technetium Pertechnetate. Kostamis, P.; Constantinides, C.; Papageorgiou, C.; Binopoulos, D.; Malamos, B. (Univ. of Athens). pp 208-212 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The effect of intracranial hypertension on cerebral blood flow is dependent on the height of the intracranial pressure and the rapidity of its development. With a progressive or slight increase of the intracranial pressure, the autoregulatory mechanisms of the brain circulation are mobilized, whereas with an abrupt or great rise of the intracranial pressure, the autoregulation is disrupted resulting in a decrease of the cerebral blood flow. In the present communication an attempt has been made to study in a group of experimental animals cerebral blood flow during an acute rise of intracranial pressures produced by introducing a neutral foreign body in the extradural space. Cerebral blood flow changes were estimated from curves obtained by scanning using ^{99m}Tc-pertechnetate and the Anger camera with its special attachments, namely the 1600 word memory, a magnetic tape recorder, data processor and fast printer. (auth)

16906 MODIFICATION OF THE CLEARANCE RATE OF INHALED ^{59}Fe$_2$O$_3$ PARTICLES BY METOPIRONE. Schorn, H.; Walter, C.; Lafuma, J. (CEA, Fontenay-aux-Roses, France). pp 232-237 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

It has been shown that high doses of glucocorticoids cause a depression of phagocytic activity. The influence of substances which interfere with the biosynthesis of adrenal hormones has been studied and in particular metopirone. This substance selectively inhibits the 11-β-hydroxylation because of increased production of 11-desoxy-corticosterone. In order to test the system, the clearance rate of inhaled ^{59}Fe$_2$O$_3$ particles was measured in male rats. A statistically significant increase in the removal of the ^{59}Fe$_2$O$_3$ could be shown. This effect was dependent on the dose and mode of administration. Further experiments on the mechanism of glucocorticosteroid action on phagocytosis will be discussed. The results of these studies with labelled cells can be interpreted as a reduction of macrophage mobility by a high concentration of glucocorticosteroids; this can be normalized by metopirone. (auth)

16907 DYNAMICS OF ^{67}Ga AND ^{111}In UPTAKE. Studies on the Model of the Walker Carcinoma of the Rat. Matzku, S.; Georgi, P.; Helus, F.; Scheer, K. E.; Sinn, H. J. (Deutsche Krebsforschungszentrum, Heidelberg). pp 479-484 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Gallium-67 and ^{111}In (administered as citrate) uptake in rat Walker tumors were studied during various stages of growth. Measurements included total body retention and distribution of the two nuclides and values for 6 day accumulation. The time course of these parameters was identical for both tracers, but the uptake of ^{111}In was greater than that of ^{67}Ga. It is suggested that blood flow through the tumor may have an influence on the results. (auth)

Plants

Refer also to abstract 19157.

16908 (COO-2447-1) BEHAVIOR OF TECHNETIUM-99 IN SOILS AND PLANTS. Progress Report, April 1, 1974—March 31, 1975. Gast, R. G. (Minnesota Univ., St. Paul (USA). Dept. of Soil Science). 1975. Contract AT(11-1)-2447. 42p. Dep. NTIS $5.25.

Mechanisms involved in ^{99}Tc sorption by soils and uptake by plants were investigated. Studies included sorption of ^{99}Tc from aqueous solution by eleven well characterized Minnesota soils and the short-term uptake of ^{99}Tc from solution by a variety of agronomic and horticultural crops. (CH)

16909 (COO-3015-8) SOME FACTORS AFFECTING BETA PARTICLE DOSE TO TREE POPULATIONS IN THE EASTERN NEW ENGLAND AREA FROM STRATOSPHERIC FALLOUT TO 1974. Final Report. Russell, I. J. (Boston Coll., Chestnut Hill, Mass. (USA). Dept. of Chemistry). Aug 1974. Contract AT(11-1)-3015. 63p. Dep. NTIS $6.25.

Measurements of radionuclide content in whole trees during the 1969 to 1972 period have provided scale factors for estimating the dose delivered to tree communities as a result of nuclear testing to date. These scale factors can be used to provide measures of internal and external dose to trees per unit of radioactivity introduced into the northern hemisphere stratosphere according to the pattern of the 3 megaton Chinese tests. To date these factors apply only to the New England area. Further measurements of a similar nature to those performed in this work will be required to extend the scaling model to other climatic regimes. The rare earth nuclides are found to be the most significant contributors to beta dose received by meristematic tissue. The ^{144}Ce-^{144}Pr pair alone may deliver an infinity dose of .1ε rad per megaton equivalent of stratospheric source, where ε is the fraction of beta decay energy absorbed by young tissue. It is estimated that 6ε rads have been delivered to one and two year twig tissue of the white pine from the 1961-1962 U.S.-U.S.S.R. test series in New England, by ^{144}Ce-^{144}Pr. (auth)

16910 (NP-20217) SOME REFERENCES TO RADIUM, BERYLLIUM, SILVER, GOLD, URANIUM, AND THORIUM IN SOILS AND PLANTS (1955-1973). (Commonwealth Agricultural Bureaux, Slough (UK)). Apr 1974. 16p. UK £1.30.

This annotated bibliography contains sixty-eight items, of which a majority include references to one or more of the elements of importance in nuclear technology. The subjects covered include the chemical composition of soils and plants and the effect of particular elements on plant growth. (UK)

New Tracer Techniques

Refer also to abstracts 15902, 15903, 15912, 15975, 16126, 16588, 16592—16598, 16601, 16706, 16838, 16844, 16863, 16901—16903, 16905—16907, and 19155.

16911 (BNL-19485) CLINICAL USE OF IODINE-123. Atkins, H. L. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 25p. (CONF-741143-1). Dep. NTIS $4.25.

From conference of the New England chapter of the Society of Nuclear Medicine; Newport, Rhode Island, USA (1 Nov 1974).

Iodoantipyrine labeled with ^{123}I gave good results when used as a tracer for brain perfusion studies. Results of studies of the tissue distribution are reported. (CH)

16912 (COO-3400-25) REGULATION OF CALCIUM METABOLISM IN CATTLE DURING GROWTH, GESTATION, LACTATION, AND CHANGES IN DIET. Ramberg, C. F.; Kronfeld, D. S.; Wilson, G. D. A. (Pennsylvania Univ., Kennett Square (USA). School of Veterinary Medicine). 1974. 21p. Dep. NTIS $4.25.

Elementary mechanisms for plasma calcium homeostasis probably develop early in fetal life, but it is not until the latter third of gestation that large amounts of calcium are transported across the placenta and incorporated into the developing fetal skeleton. After birth, calcium incorporation into bone varies in line with changes in the rate of growth. The transport of the large amounts of calcium required for bone growth without disturbing plasma calcium concentration is a major homeostatic challenge during the first two years of life. In pregnant animals, the need for increased amounts of calcium for transport to the fetus develops relatively slowly, but terminates abruptly at parturition. At the same time, the calcium requirement for milk secretion increases suddenly, continues to rise till the peak of lactation, then declines fairly slowly. To maintain a stable plasma calcium concentration during these changing demand situations, homeostatic mechanisms must respond appropriately in both magnitude and rate, and be capable of adjusting their responses to compensate for a variable amount and availability of mineral in the diet. (auth)

16913 (DHEW-(NIH)-75-683) INTERNATIONAL CONFERENCE ON BONE MINERAL MEASUREMENT, CHICAGO, ILLINOIS, OCTOBER 12–13, 1973. Mazess, R. B. (ed.). (National Inst. of Arthritis, Metabolism, and Digestive Diseases, Bethesda, Md. (USA)). [nd]. 407p. (CONF-731036-).

Separate abstracts were prepared for the 28 papers included. (CH)

For abstracts of individual papers see: 16838, and 16914–16940.

16914 (DHEW-(NIH)-75-683, pp 1-10) PHYSICAL ASPECTS OF ^{125}I BONE ABSORPTIOMETRY. Judy, P. F. (Peter Bent Brigham Hospital, Boston). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

The magnitude of errors in photon transmission scanning measurement of bone mineral mass was estimated from a detailed physical description of the measurement and an analysis of the validity of the assumptions made in the derivation of the formula used to calculate the bone mineral mass. The derivation assumes exponential attenuation and a division of the human body into two components, each having a unique mass attenuation coefficient and density. The accuracy of bone mineral absorptiometry using ^{125}I as the photon source was found to be determined by hardening the photon beam and variation in the distribution of adipose tissue in the body. The hardening error was estimated to be ±2% when the system was calibrated over the biological range of bone mineral mass. The variations of adipose tissue thickness inside the bone and subcutaneously have been shown to depend critically on the method of determining the baseline. The errors caused by the detection of scattered radiation and the finite size of the photon beam have been shown to be less than 1% for a system calibrated by an ash study. The instrumental reproducibility of the ^{125}I measurement of bone mineral mass has been limited by the number of photons detected. The activity of ^{125}I, the detector geometry, and the scan rate in the clinical instruments have been such that the precision of measurement of bone mineral mass of the radius is 1% to 2%. (auth)

16915 (DHEW-(NIH)-75-683, pp 11-29) UNIVERSITY OF ALBERTA BONE MINERAL ANALYSIS SYSTEM: PERFORMANCE AND CLINICAL APPLICATION. Overton, T. R.; Silverberg, D. S.; Rigal, W. M.; Friedenberg, L. (Univ. of Alberta, Edmonton). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

A system for bone mineral content (BMC) photon transmission scanning measurements using the Cameron photon absorption technique and ^{241}Am as the photon source was developed. This precision scanning device is readily adapted to make measurements at several body sites including the metacarpals, radius, femur, and vertebrae. Provision is made for single and for multiple source mounting, and two channels of pulse-height analysis and recording are available, permitting the use of both single and dual photon measurement techniques. The studies described concern measurements of bone phantoms and of the human femur. Normal values for BMC and bone width for the distal femur have been obtained for small groups of healthy subjects (39 females, 35 males). Measured BMC values for groups of male (42) and female (28) patients with renal disease have been compared with the normal values. (CH)

16916 (DHEW-(NIH)-75-683, pp 30-33) METHOD FOR THE DETERMINATION OF THE COMPACTA AREA AND THE MEAN ABSORPTION DENSITY OF HUMAN BONES. Ruegsegger, P.; Niederer, P.; Anliker, M. (Univ., Zurich). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

It has been shown that it is possible to determine the bone mineral content to an accuracy of a few percent from noninvasive absorption measurements of soft γ rays. Extensions of the Cameron technique were studied on excised bones in an effort to obtain additional information on the bone status. Size and shape of the compacta as well as its mean absorption density may also be evaluated in addition to the total mineral content. This is accomplished by repeating the linear scanning process at a given cross section of the bone thirteen times by rotating the collimated beam of γ rays through 15° after each scan. (CH)

16917 (DHEW-(NIH)-75-683, pp 34-38) PRELIMINARY REPORT: CORRELATION OF TOTAL BODY CALCIUM (BONE MASS), AS DETERMINED BY NEUTRON ACTIVATION ANALYSIS WITH REGIONAL BONE MASS AS DETERMINED BY PHOTON ABSORPTION. Chestnut, C. H. III; Manske, E.; Baylink, D.; Nelp, W. B. (Univ. of Washington Hospital, Seattle). [nd].

From international conference on bone mineral measurement. Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

The recent development of total body neutron activation analysis (NAA) allows accurate determination of total body calcium (TBC) and precise measurement of calcium balance. A unique measurement of total bone mineral mass is thereby obtained; the procedure however requires special facilities for neutron exposure and total body counting. Measurement of regional bone mass (RBM) by photon transmission scanning is relatively rapid and simple and utilizes equipment commercially available. Both techniques provide important and significant data in assessing bone wasting disease and disease therapy. There is uncertainty however as to whether the mass of a small segment of one bone reflects total skeletal mass, and whether one bone mass reflects the mass of another bone. Measurements of RBM were compared at six sites along the radius, ulna, and humerus, and the multiple RBM measurements were compared to TBC. The relative efficacies and correlations of the two techniques were obtained. Fourteen patients with osteoporosis, age 56 to 76, (2 males, 12 females) were studied; each patient demonstrated compression fractures and/or skeletal demineralization. (CH)

16918 (DHEW-(NIH)-75-683, pp 39-50) CORRELATION OF RADIAL BONE MINERAL CONTENT WITH TOTAL-BODY CALCIUM IN VARIOUS METABOLIC DISORDERS. Cohn, S. H.; Ellis, K. J.; Zanzi, I.; Letteri, J. M.; Aloia, J. (Brookhaven National Lab., Upton, NY). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

Loss of bone mineral content of the skeleton in osteoporosis and in other metabolic disorders can be measured directly by total-body neutron activation analysis (TBNAA). The photon transmission scanning technique (using monochromatic photons from ^{125}I) applied to the appendicular skeleton (radius) also reflects the loss of bone mineral in osteoporosis. The results of these two techniques are compared in 80 patients with various metabolic disorders and in 9 normal contrast subjects. It is apparent that there is good correlation between total body calcium (TBCa) and bone mineral content (BMC) in all groups studied. The correlation was highest in the normal contrast group (0.97) and alcoholics (0.98) and lowest in osteoporotic patients (0.83) and in renal patients on dialysis (0.84). (CH)

16919 (DHEW-(NIH)-75-683, pp 51-59) PREDICTION OF FEMORAL NECK AND SPINE BONE MINERAL CONTENT FROM THE BMC OF THE RADIUS OR ULNA AND THE RELATIONSHIP BETWEEN BONE STRENGTH AND BMC. Wilson, C. R. (Univ. of Wisconsin Hospitals, Madison). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

The bone mineral content (BMC) measured by photon transmission scanning techniques is extensively used to provide information about the status of entire skeleton. Changes in BMC are employed to evaluate the effect of various drugs, both beneficial and detrimental, disease states, weightlessness, exercise, renal dialysis, and others on the skeleton. Specific clinical and functional information that may be derived from the BMC of a limited region of the skeleton is discussed. In particular there is a fairly high degree of correlation between the BMC of the radius or ulna and that of the femoral neck and a somewhat lower relationship between the BMC of the radius or ulna and the thoracic vertebrae. Also the BMC is highly related to the strength of bone at that scan site. (CH)

16920 (DHEW-(NIH)-75-683, pp 60-65) BONE MINERAL ASSAY: CHOICE OF MEASURING SITES. Dalen, N. (Karolinska Inst., Stockholm). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

In most earlier clinical studies of bone mineral content only one site was studied by each investigator. The object of the present study was to collect data by the x-ray spectrophotometric method for measurement of the bone mineral content at various sites during different clinical conditions, such as alcoholics, patients with primary hyperparathyroidism, patients with chronic renal failure, non-patients, and athletes. The sites were radius and ulna distal and shaft, head of humerus, third lumbar vertebra, femur neck and shaft, and calcaneus. The deviation in bone mineral content in cross-sectional studies, the change in bone mineral content with time in longitudinal studies, and the correlation to morphological signs of osteoporosis in skeletal radiographs were more pronounced at sites containing trabecular bone than at sites containing cortical bone. The sites containing trabecular bone are therefore usually to be preferred, in spite of the great biological variation and the comparatively low attainable precision at these sites. The correlation between different sites in the same individual is weak, and the bone mineral content at the different sites deviates relative to controls in a varying way. Therefore, several sites should be measured to avoid erroneous conclusions. (auth)

16921 (DHEW-(NIH)-75-683, pp 66-72) DIRECT READOUT OF BONE MINERAL CONTENT WITH DICHROMATIC ABSORPTIOMETRY. Kan, W. C.; Wilson, C. R.; Witt, R. M.; Mazess, R. B. (Univ. of Wisconsin Hospitals, Madison). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

An analog device has been constructed which provides immediate readout of bone mineral content and bone width from photon transmission scans with two photon beams with different energies such as ^{153}Gd (43 keV and 100 keV) or ^{125}I/^{241}Am (28 keV and 60 keV). The system and preliminary results are described. (CH)

16922 (DHEW-(NIH)-75-683, pp 73-79) ANALYSIS OF ^{153}Gd AND OF ^{125}I/^{241}Am SOURCES. Hanson, J. (Univ. of Wisconsin Hospitals, Madison). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

The precision of the dual photon transmission scanning technique of measuring bone mineral content was modeled mathematically as an expression based on counting statistics. For a given amount of bone and soft tissue there is an optimal photon energy pair. When the initial intensities of the photon beams are equal, the optimal lower photon energy increases with increasing mass of bone and soft tissue for a given higher photon energy. Dual sources of interest are ^{125}I/^{241}Am (28 and 60 keV) and ^{153}Gd (43 and 100 keV). The bone mineral measured in thin anatomical locations (i.e. hand and forearm) with ^{125}I/^{241}Am is more precise than with ^{153}Gd. For thick locations (i.e. upper arm and calf) ^{153}Gd is more precise than ^{125}I/^{241}Am. (auth)

16923 (DHEW-(NIH)-75-683, pp 80-87) DUAL PHOTON X-RAY BEAM APPLICATIONS. Reiss, K. H. (Siemens Aktiengesellschaft, Erlangen, Ger.); Killig, K.; Schuster, W. [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

Two x-ray spectra of different penetration are obtained by switching a normal x-ray generator 5 times a second by means of thyristors. The tube voltage is alternating between about 60 to 90 kV (variable) and 150 kV (fixed). The higher energy radiation is filtered by an oscillating copper filter of variable thickness (1.5 to 4.5 mm), so that the intensities of both spectra behind the body are approximately the same. They are measured in a narrow beam by a photomultiplier behind an image intensifier. The same set is used for localization with a 7 inch image intensifier. The quotient of the two intensities delivers a figure for the bone mineral in g/cm^2. It is possible to determine bone mineral content even behind an equivalent water thickness of 35 cm. The equivalent water value is determined by a soft tissue measurement besides the bone of interest. The reproducibility of the method tested with phantoms is very good. Results with excised bones and with patients are presented. (auth)

16924 (DHEW-(NIH)-75-683, pp 88-99) DUAL ENERGY ABSORPTIOMETRY TECHNIQUE FOR BONE MINERAL CONTENT MEASUREMENT. McDonald, J. M.; Zeitz, L. (Memorial Sloan-Kettering Cancer Center, New York). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

A dichromatic, or dual energy photon, technique was developed for direct photon transmission scan measurements of bone mineral content. While the monochromatic method was shown in general to be a fast, safe, and accurate technique for evaluating bone mineralization, it was demonstrated that it is subject to errors due to the presence of adipose tissue. Using the dichromatic system, with artificial bone standards and paraffin (simulating fat) in plexiglass, we have been able to correct for the presence of the fat component, which would have otherwise produced errors of from zero to approximately 30% in the mineral content using the monochromatic technique. Corrected integral values had standard deviations from the true (no paraffin) values of up to a few percent, while the precision of the technique was approximately 2% for these measurements. (CH)

16925 (DHEW-(NIH)-75-683, pp 100-107) BONE MINERAL MEASUREMENTS USING A DICHROMATIC ATTENUATION TECHNIQUE WITH SIMULTANEOUS OPERATION IN TWO ENERGY CHANNELS. Schmeling, P. (AB Atomenergi, Studsvik, Sweden). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

In vivo measurements of bone mineral by photon transmission scanning using a single γ energy require the use of water or other tissue equivalent substances. The dichromatic technique makes measurements in air possible, as the use of two γ energies eliminates the influence of soft tissue. Simultaneous operation in two channels with automatic and continuous elimination of soft tissue was demonstrated. The primary results could be obtained directly on a recorder. It was easily possible to measure radius, ulna, humerus, femur, tibia, fibula, and patella. Even the cranium and the spine could be registered. With the equipment used the detector and electronics did not permit ideal resolution of the two photon energies, and the standard deviation therefore could not be brought below the 3% limit. The isotope used was ^{133}Xe, but the results should be applicable to ^{153}Gd and other isotopes with energies below 100 keV. (auth)

16926 (DHEW-(NIH)-75-683, pp 108-113) NEW APPARATUS FOR BONE MINERAL MEASUREMENT IN VIVO. Gebhardt, M. (Mineralogisch-Petrologisches Inst., Bonn); Zwicker, H. [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

An apparatus was constructed which permits photon transmission scanning of bone mineral content on the finger. A finger-holder keeps the middle phalanx of the finger in an exact fixable position, whereby the soft tissue parts are slightly pressed between two parallel plexiglas-windows. The total width of the finger can be measured with the help of a gauge having a calibration of 0.01 mm. The bone thickness is determined by a film photograph, whereby the measuring space is kept fixed. Absorption measurements are done with highly stabilized x-ray tubes and monochromators rather than radionuclides as photon sources. The advantage of this equipment is that it permits the application of many measurement methods on the same object; the disadvantage is its limitation to finger bones. (CH)

16927 (DHEW-(NIH)-75-683, pp 114-122) BONE STANDARDS FOR THE INTERCOMPARISON AND CALIBRATION OF PHOTON ABSORPTIOMETRIC BONE MINERAL MEASURING SYSTEMS. Witt, R. M. (Univ. of Wisconsin Hospitals, Madison). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

In order for different laboratories to compare and collate their values for bone mineral content (BMC) results there must be uniform calibration and standardization of their measuring systems. Bone standards have been constructed to provide for the intercomparison and calibration of photon transmission scanning bone measuring systems. The standards are composed of polymethyl methacrylate blocks with three annular cavities which are filled with a saturated solution of dipotassium hydrogen phosphate (KHP). The saturated KHP solution has linear attenuation properties similar to those of compact bone. The dimensions of the inner and outer diameters of the annular cavities are similar to the dimensions of the midshafts of radii and metacarpals. The bone mineral content (BMC) of these standards was calibrated by ash bone sections in units of g/cm of bone ash. The bone standards can be used to linearly calibrate absorptiometric bone measuring systems in terms of the ashed bone sections. This linear calibration has been shown to be valid for various radionuclide photon sources useful in photon transmission scanning. (CH)

16928 (DHEW-(NIH)-75-683, pp 123-129) ORGANIZATION AND PROCESSING OF BONE MINERAL DATA USING A GENERAL PURPOSE STORAGE AND RETRIEVAL PROGRAM AND A MINI-COMPUTER. Zimmerman, R. E.; Daily, T.; Snider, R.; Griffiths, H. J. (Harvard Univ., Boston). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

The measurement of bone mineral content utilizing the photon transmission scanning method has become routine in a number of major medical centers. Organization and correlation of this data with disease states, biochemical parameters, radiographic changes, and epidemiological factors is a formidable problem. An information storage and retrieval program operating on a minicomputer has been used to aid in processing data from over 1780 scans on 985 patients. The program is described along with the human factors involved, source documents, accuracy, reliability and methods of coordinating the data. (CH)

16929 (DHEW-(NIH)-75-683, pp 130-141) BONE MINERAL COMPUTATION WITH A RECTILINEAR SCANNER. Ullman, J.; Brown, S.; Silverstein, A.; Vogel, J. (Univ. of California, Davis). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

A portable rectilinear transmission scanner and associated computerized data reduction techniques for estimating bone mineral content by photon transmission scanning are described. This unit can be easily disassembled for transport to various measurement sites and has been used to estimate the bone mineral content of the os calcis, radius, and ulna. The scanner is used to obtain multiple rows of data from which a bone profile is derived. Bone edges are determined with the aid of a digital computer program which employs an algorithm that determines the greatest rate of change of the counting rate. This program is particularly useful for determining the edges of bones surrounded by varying tissue distributions. (auth)

16930 (DHEW-(NIH)-75-683, pp 142-150) COMPUTERIZED METHOD OF DETERMINATION OF BONE MINERAL CONTENT BY A TRANSMISSION-SCANNER. Description of the System. Schneider, U.; Banzer, D. (Freie Univ., Berlin). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

A transmission-scanner was developed for photon transmission scanning that includes a movable x-ray tube. Additional information about geometry and structure of the bone which has been examined for mineral content is obtained by several radiographs in the plane of measurement. The data is evaluated by a computer and is stored on magnetic tape, together with clinical information. Automatic reports for the physician are printed and scientific evaluation is possible by several programs. With special equipment the bones of small animals may be measured. Most of the human measurements were done on the calcaneus. Normal ranges for this bone were evaluated. (auth)

16931 (DHEW-(NIH)-75-683, pp 151-154) IN VIVO CALCIUM DETERMINATION BY PROTON ACTIVATION ANALYSIS. Eilbert, R. (Harvard Univ., Cambridge, MA). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

A method for in vivo calcium measurement in bones is being developed at the 160 MeV proton cyclotron of Harvard University. Advantages of the technique include direct measurement of calcium in the lumbar vertebrae and restriction of dose to the immediate vertebral region. The technique may be of particular use in plotting serial changes of a patient's calcium level in response to treatment. Proton activation of ^{40}Ca (97% abundant) in bone produces ^{38}K. This radionuclide undergoes beta decay, emitting a 2.17 MeV gamma ray with a half life of 7.7 minutes. Knowledge of the proton flux and efficient detection of the subsequent γ radiation allow a precise determination of calcium in vivo. After irradiation, the subject is removed to the counting area for a roughly 15 minute count period. High detection efficiency for the 2.17 MeV γ is achieved through anterior-posterior positioning of two 9.4" × 5" NaI(Tl) scintillators. (CH)

16932 (DHEW-(NIH)-75-683, pp 155-160) EVALUATION OF SEVERAL NUCLIDES FOR BONE DENSITY DETERMINATIONS BY COMPTON SCATTERING. Piper, D. G.; Preuss, L. E.; Bolin, F. P. (Edsel B. Ford Inst. for Medical Research, Detroit). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

Results are reported of an evaluation of the isotopes available for use as photon sources for transmission scanning for measurements of bone density. Only those isotopes with γ energies of 80 to 200 keV were investigated. Nuclides with half-lives shorter than 100 days were eliminated as being impractical. A dose of more than one rad was considered excessive, removing more possibilities. Some of the remaining isotopes had several emissions which would interfere with the desired energy, or were too expensive to produce. The nuclides studied were ^{133}Ba, ^{170}Tm, ^{109}Cd, ^{155}Eu, ^{153}Gd, ^{108m}Ag, ^{57}Co, ^{75}Se, ^{144}Ce, ^{139}Ce, ^{125}Sb, and ^{166m}Ho. (CH)

16933 (DHEW-(NIH)-75-683, pp 161-168) CORRELATION OF OS CALCIS AND SPINAL BONE BY COMPTON SCATTERING. Luther, R. (Univ., Erlangen, Ger.). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

The mineral content of 50 os calcis and 50 spines were measured simultaneously in patients using the Compton scattering method. The results were established statistically. Investigations in vitro showed that the mineral is so inhomogeneously distributed in the os calcis that a single measurement is not able to provide any information about the average hydroxyapatite (HA) percentage of this bone. (auth)

16934 (DHEW-(NIH)-75-683, pp 169-176) PROGRESS IN RADIOGRAPHIC PHOTODENSITOMETRY. Colbert, C.; Bachtell, R. S. (Wright State Univ. Research Inst., Dayton, OH). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

To determine the skeletal status of a patient and his response to therapy, radiological estimates of bone weight, size, and density were obtained from a pair of radiographs of the left hand compared with age and sex-matched control values. The x-ray film image was scanned by a microdensitometer connected on-line to a small computer which prints out a skeletal status report based on findings from two films of the same fingers. The second film, taken at kilovoltage and exposure settings different from the first, is used to confirm the findings. (auth)

16935 (DHEW-(NIH)-75-683, pp 206-213) COMPUTERIZED METHOD OF DETERMINATION OF BONE MINERAL CONTENT BY A TRANSMISSION-SCANNER. Clinical Use. Banzer, D.; Schneider, U. (Freie Univ., Berlin). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

The value of clinical applications of photon transmission scanning for measurements of bone mineral was studied in 1500 measurements on patients with different diseases involving the skeletal system. Measurements on patients with chronic renal disease, including those on hemodialysis or post renal transplant were performed. A bone mineral loss up to 50% was observed. The mineral content of the os calcis depends on the duration of the disease as seen in follow-up studies over two years. About 50 measurements were done on patients with disturbance of the ovarial function. These patients showed a significant demineralization and characteristic changes of bone density under therapy with estrogens. A decrease of bone mineral content was also seen in patients with hyperthyroidism, thyroidectomy, rheumatic diseases, vascular diseases, and fractures of the lower extremities. A post-operative follow-up study after parathyroidectomy demonstrates the prognostic value of the method in hyperparathyroidism. (auth)

16936 (DHEW-(NIH)-75-683, pp 225-227) PHOTON ABSORPTION METHOD AND SINGH INDEX IN THE DETECTION OF OSTEOPOROSIS: A COMPARATIVE STUDY. Wahner, H. W.; Riggs, B. L.; Beabout, J. W. (Mayo Clinic, Rochester, MN). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

A number of techniques for the estimation of bone mineral are under study by different laboratories, but none is accepted unconditionally for routine clinical use. Results are reported from a comparative study of two methods, namely photon transmission scanning and the skeletal radiographic grading method of Singh in its ability to separate normal females over 45 years from females of the same age but with compression fractures of the spine of nontraumatic origin. (CH)

16937 (DHEW-(NIH)-75-683, pp 277-281) BONE MINERAL DETERMINATION OF RADIUS, ULNA, AND FINGERBONES BY ^{125}I PHOTON ABSORPTIOMETRY ON HEALTHY PERSONS. Kuhlencordt, F.; Ringe, J. D.; Kruse, H. P.; Roth, A. v. (Univ., Hamburg). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

One-hundred and forty healthy persons, 77 women and 63 men, were examined for bone mineral content by photon transmission scanning using ^{125}I as the source in order to obtain normal values for the population. The site measured was at a point $\frac{1}{3}$ the distance from the distal end of the radius. Measurements at the corresponding site of the ulna and across the middle of the basic phalanx of the second, third, and fourth finger were also made. Results showed a small mineral loss between the 35th and 65th year of life, which was more marked in women. (CH)

16938 (DHEW-(NIH)-75-683, pp 293-301) TRANS-IMAGING OF BONE ALLOGRAFTS: A RAPID METHOD FOR EVALUATING OSSEOUS INCORPORATION. Bright, R. W. (National Naval Medical Center, Bethesda, MD); McManaman, V. L.; Strash, A. M. [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

In order to reconstruct patients who have sustained massive bone losses, either traumatic or post-surgical, large osseous bone grafts were implanted. These allografts must become incorporated, however, before structural and functional integrity is regained. A non-invasive technique for quantitative evaluation of graft incorporation is required in order to assess and direct the post-operative care of such a patient. Photon transmission scanning using rectilinear scanning with ^{241}Am source provided a method for such evaluations, and a number of 2 cm bone grafts in dog ulnas were scanned sequentially. Bone resorption was followed proximally, distally, and through the body of the graft by multiple passes with the probe. Since this technique proved to be so time-consuming, the high performance gamma camera was selected to image the entire extremity area. Maximum utilization of the grid was accomplished by focusing the source and bone specimen some distance from the camera so as to project an enlarged image. A computer was then repeatedly directed to bisect the image and to plot the multiple scans from the single image. Bone mineral content throughout the graft and surrounding host bone was then determined, and this data was stored for comparison with sequential scans. This latter method was not only much faster, but the sensitivity of the technique was maintained. It was concluded that this method can play an important clinical role in patient care as well as provide the researcher with a better tool for evaluating and selecting the best possible grafting material. (auth)

16939 (DHEW-(NIH)-75-683, pp 337-345) ROLE OF PHOTON ABSORPTIOMETRY IN THE DIAGNOSIS AND FOLLOW-UP OF PATIENTS WITH RENAL FAILURE. Griffiths, H. J.; Zimmerman, R. E. (Harvard Univ., Boston). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

Using a ^{125}I source, the photon transmission scanning method was used to measure bone mineral, and 800 measurements have been performed on the cortical bone of the lower arm in 382 patients with renal failure representing every stage of the disease. The following conclusions can be drawn from the data: prolonged azotemia leads to severe loss of bone mineral which, in the early stages, is only detectable using photon absorptiometry; there is inexorable loss of bone mineral while the patient is on dialysis; parathyroidectomy may slow this loss of bone mineral but fails to correct the osteomalacia that many of these patients have concurrently with secondary hyperparathyroidism; after kidney transplantation the rate of bone loss will either decrease or cease, but few patients demonstrate any increase in bone mineral. (auth)

16940 (DHEW-(NIH)-75-683, pp 346-351) CORRELATION OF RADIOGRAPHIC BONE SURVEYS WITH BONE MINERAL VALUES OBTAINED USING A PHOTON ABSORPTIOMETRIC TECHNIQUE IN A GROUP OF 315 PATIENTS WITH CHRONIC RENAL FAILURE: A PRELIMINARY REPORT. Griffiths, H. J.; Zimmerman, R. E.; Bailey, G. (Harvard Univ., Boston). [nd].

From international conference on bone mineral measurement; Chicago, Illinois, USA (12 Oct 1973).

In international conference on bone mineral measurement.

Radiographic and photon transmission scanning measurements of bone mineral content were done on 315 patients at all stages of renal failure. Bone mineral was subnormal in 32% of the patients. Various components of renal osteodystrophy occurred in combinations, and were often associated with a decrease in the bone mineral content. Both radiographic and absorptiometric studies should be performed at three month intervals, if the patient has normal bone and more frequently if bone mineral starts to decrease. (auth)

16941 UTERINE BLOOD FLOW IN DOGS DURING VARIOUS DEPTHS OF HALOTHANE ANESTHESIA MEASURED BY LOCAL INJECTION OF ^{133}Xe. Einer-Jensen, N. (Odense Univ., Denmark); Juhl, B. Acta Anaesth. Scand.; 18: 123-126(1974).

The correlated values of cardiac output and uterine blood flow (measured with ^{133}Xe) were determined on eight dogs. This was done both under basis anesthesia with controlled ventilation and during the addition of 0.5% and 1.0% halothane to the inspiratory air. A fall in cardiac output and uterine blood flow was demonstrated during the addition of halothane. With 0.5% halothane, the fall was on an average 30 and 17% of the initial values, respectively, and with 1.0% halothane, it was 49 and 42% of the initial values. The uterine blood flow varied considerably from animal to animal, and these values were not correlated to the Pa_{CO_2} changes carried out within the range of Pa_{CO_2} from 25 to 66 mmHg. (DE)

16942 METABOLISM AND BINDING PROPERTIES OF ^{3}H-ALDOSTERONE IN PLASMA AND ITS SEX DEPENDENCE IN ADRENALECTOMIZED RATS. Morris, D. J.; Graham, W. C.; Davis, R. P. (Brown Univ., Providence). Endocrinology; 96: No. 1, 178-184(Jan 1975).

The rates of clearance of plasma ^{3}H-radioactivity following intravenous injection of ^{3}H-aldosterone was demonstrated to be sex-dependent in adrenalectomized rats. The percentage plasma radioactivity which is CH_2Cl_2-extractable is greater in female than in male rats from 5 min to 90 min postinjection; however, the quantities of CH_2Cl_2-extractable label are not significantly different until 60 min postinjection. The quantities of nonextractable, water-soluble metabolites of aldosterone (NEPD), which are markedly greater in the plasma of males, reach peak levels 30 min after injection of aldosterone, during the latent period of the hormone. In females, these polar metabolites (NEPD) are rapidly cleared from the blood. The quantities of ^{3}H-radioactivity associated with the plasma binding proteins are similar in both males and females. The unbound levels of aldosterone and its metabolites are significantly greater in the plasma of males. These findings indicate that the sex hormones may influence not only the metabolism of aldosterone in rats, but also the plasma levels of unmetabolized aldosterone and its metabolites. (auth)

16943 CLINICAL EXPERIENCE WITH ^{99m}Tc-DMSA (DIMERCAPTOSUCCINIC ACID), A NEW RENAL-IMAGING AGENT. Handmaker, H.; Young, B. W.; Lowenstein, J. M. (Children's Hospital of San Francisco). J. Nucl. Med.; 16: No. 1, 28-32 (Jan 1975).

Results are reported from the clinical evaluation of a new radiopharmaceutical for renal imaging, ^{99m}Tc-DMSA (dimercaptosuccinic acid). Sixty-five patients were studied and six of these patients' scintiphotos are illustrated. The physical characteristics of ^{99m}Tc and the mercurial-like kinetics of the chelate produced high-resolution scintiphotos of the renal parenchyma in patients of all ages and with a variety of disease entities. The commercial availability of the material in kit form permits its usage in all nuclear medicine facilities. (auth)

16944 RADIOIODINATED FATTY ACIDS FOR HEART IMAGING: IODINE MONOCHLORIDE ADDITION COMPARED WITH IODIDE REPLACEMENT LABELING. Robinson, G. D. Jr.; Lee, A. W. (Univ. of California, Los Angeles). J. Nucl. Med.; 16: No. 1, 17-21(Jan 1975).

Radioiodinated fatty acids were proposed as agents for use in heart imaging. Previous studies in experimental animals and humans using ^{131}I-oleic acid of low specific activity were marginally successful. Higher specific activity compounds offer potential improvement for use as imaging agents for normal myocardium. Methods for preparation of high specific activity, radioiodinated fatty acids by iodine monochloride addition to oleic, linoleic, and linolenic acids, and iodide replacement of terminal bromine in 6-bromohexanoic, 11-bromoundecanoic, and 16-bromo-9-hexadecenoic acids are presented and compared. Although both labeling procedures are suitable for use with ^{123}I, the latter synthetic route gives labeled fatty-acid analog molecules and 16-iodo-9-hexadecenoic acid appears to show improved myocardial specificity in preliminary animal studies. (auth)

16945 ^{67}Ga IN 68 CONSECUTIVE INFECTION SEARCHES. Harvey, W. C.; Podoloff, D. A.; Kopp, D. T. (Air Force Medical Center, Lackland AFB, TX). J. Nucl. Med.; 16: No. 1, 2-4 (Jan 1975).

When employed in the study of peripheral infections, ^{67}Ga scanning is sensitive and accurate. When used as a diagnostic tool for suspected abdominal abscesses, it locates and delineates abscesses in somewhat over half the cases. Moreover, the true-negative rate is high and the false-positive rate is acceptably low. Gallium scans should be interpreted with all available clinical information. The coexistence of neoplasm is a problem that at present is not completely resolved. (auth)

16946 LABELING OF PHAGOCYTES FROM HUMAN BLOOD WITH ^{99m}Tc-SULFUR COLLOID. English, D.; Andersen, B. R. (Univ. of Illinois, Chicago). J. Nucl. Med.; 16: No. 1, 5-10 (Jan 1975).

Experiments showed that peripheral blood leukocytes can be readily labeled with ^{99m}Tc-sulfur colloid during in vitro incubation. Phagocytic cells were preferentially labeled by this method. Labeling was enhanced in the presence of normal serum. The data suggest that labeling was accomplished by phagocytosis of the radiocolloid. Labeled granulocytes responded normally to chemotactic stimuli and excluded trypan blue dye normally. Buffy coat cells from 50 ml of peripheral blood could be labeled with 8 mCi of ^{99m}Tc after incubation with 20 mCi of TsSC. This report offers a method by which phagocytic cells can be selectively labeled with ^{99m}Tc in amounts suitable for scintillation scanning. (auth)

16947 RADIOSCINTIGRAPHIC STUDIES OF ^{11}C DISTRIBUTION IN CATS GIVEN 1-^{11}C-ETHANOL. DeGrazia, J. A.; Rodden, A. F.; Teresi, J. D.; Busick, D. D.; Walz, D. R. (Stanford Univ., CA). J. Nucl. Med.; 16: No. 1, 73-76(Jan 1975).

In vivo studies of ^{11}C isotope distribution in cats given 1-^{11}C-ethanol show accumulation of radioactivity in liver. Redistribution of radio-label occurs after ethanol loading. Results indicate that some aspects of the metabolism of ethanol in specific tissues can be assessed by gamma scintigraphy. (auth)

16948 RED CELL AND PLASMA VOLUMES IN NORMAL ADULTS. Hurley, P. J. (Auckland Hospital, New Zealand). J. Nucl. Med.; 16: No. 1, 46-52(Jan 1975).

Despite numerous published methods for predicting normal red cell and plasma volumes, little is known of the range of normal in subjects of given body dimensions. In this study, reported results of red cell and plasma volumes in 481 normal men and 303 normal women have been used to calculate mean volumes and standard deviations (s.d.) for any given body surface area (male and female results being kept separate). All of these volumes, each ±2 s.d., have been plotted against body surface area. The resulting graphs of means and 95% confidence limits have tended to be curvilinear. Standard deviations have increased with increasing mean volumes, but coefficients of variation (s.d./mean) have shown considerable constancy at 11 to 12%. The mean values observed in this series have often differed substantially from those predicted from published formulas. Use of the presently observed means with the 11 to 12% coefficients of variation allows compilation for any surface area of a range of normal against which a clinically obtained volume can be compared. (auth)

16949 EVALUATION OF ^{99m}Tc-SULFUR COLLOID LIVER SCINTISCANS AND THEIR USEFULNESS IN METASTATIC WORKUP: A REVIEW OF 1,424 STUDIES. Lunia, S.; Parthasarathy, K. L.; Bakshi, S.; Bender, M. A. (Roswell Park Memorial Inst., Buffalo). J. Nucl. Med.; 16: No. 1, 62-65 (Jan 1975).

To determine the clinical usefulness of liver scintiscanning in detecting metastatic disease of the liver, 1,424 liver studies performed on 1,115 patients were reviewed along with their charts. Five hundred eighty-one patients had histopathological evaluation by needle biopsy of the liver, laparotomy, and/or autopsy within a mean period of 40 days of liver scan. The histopathological findings were correlated with the liver scintiscan findings and the latter gave an overall accuracy of 77.3%. (auth)

16950 COMPARISON OF ^{111}In WITH ^{52}Fe and ^{99m}Tc–SULFUR COLLOID FOR BONE MARROW SCANNING. Merrick, M. V.; Gordon-Smith, E. C.; Lavender, J. P.; Szur, L. (Hammersmith Hospital, London). J. Nucl. Med.; 16: No. 1, 66-68(Jan 1975).

Under most circumstances ^{52}Fe, ^{111}In, and colloid show a similar distribution of marrow. The lesser uptake of ^{111}In by liver and spleen may occasionally be of value in permitting visualization of that portion of the spinal marrow obscured by these organs in the colloid scan. However, in red cell aplasia, when there is dissociation between phagocytic and erythropoietic functions, scanning with ^{111}In gives no information about erythropoietic tissue distribution. Therefore, indium cannot be used as an analog for iron in the study of the hematopoietic system. (auth)

16951 CLINICAL CORRELATION OF HEPATIC FLOW STUDIES. Witek, J. T.; Spencer, R. P. (Yale Univ., New Haven). J. Nucl. Med.; 16: No. 1, 71-72(Jan 1975).

In 100 consecutive hepatic flow studies, 84 were read as negative. Of these, 73 (87%) also had negative static images. Knowing the nature of the primary tumor did not definitively aid in predicting whether hepatic metastases would have detectable early flow. Five cases showed early flow without defects seen in the static images. Three of these were probably related to lymphomas or allied disorders with altered flow. Two cases were in individuals with gastric carcinoma who had abdominal radiation. One extrahepatic tumor was detected in the series. (auth)

16952 MIGRATION AND EMBOLIZATION OF MACROPHAGES TO THE LUNG: A POSSIBLE MECHANISM FOR COLLOID UPTAKE IN THE LUNG DURING LIVER SCANNING. Mikhael, M. A.; Evens, R. G. (Washington Univ., St. Louis). J. Nucl. Med.; 16: No. 1, 22-27(Jan 1975).

Estrogenic stimulation of the RES in animals will result in the mobilization of large numbers of phagocytic cells from their natural sites of storage, chiefly the liver, spleen, and bone marrow, into the intravascular space. These cells are trapped in the pulmonary capillary bed and retain their ability to phagocytize colloidal particles. This is suggested to be the mechanism whereby increased lung uptake of colloidal radiopharmaceuticals is observed in some patients with liver diseases or other conditions stimulating the RES. It is further postulated that the known increase of estrogenic hormones in some patients with liver disease may be the in vivo stimulation resulting in increased mobilization of RES cells to the lung and subsequent isotope entrapment. It is possible that prognostic information can be obtained from this finding; however, its exact significance cannot be determined from this present study. (auth)

16953 HIGH TEMPORAL RESOLUTION ECG-GATED SCINTIGRAPHIC ANGIOCARDIOGRAPHY. Green, M. V.; Ostrow, H. G.; Douglas, M. A.; Myers, R. W.; Scott, R. N.; Bailey, J. J.; Johnston, G. S. (National Insts. of Health, Bethesda, MD). J. Nucl. Med.; 16: No. 1, 95-98(Jan 1975).

The cardiac blood pool is visualized with high temporal resolution during a complete, average, cardiac cycle. The technique yields both qualitative and quantitative measures of cardiac performance. (auth)

16954 INCREASED UPTAKE OF ^{99m}Tc–SULFUR COLLOID IN VERTEBRAL COMPRESSION FRACTURES. Shook, D. R.; Reinke, D. B. (Veterans Administration Hospital, Minneapolis). J. Nucl. Med.; 16: No. 1, 92-94(Jan 1975).

Increased uptake of ^{99m}Tc-sulfur colloid in vertebral bodies of two patients with vertebral compression fractures was noted on a liver–spleen scan. This finding has not previously been reported in the literature. The mechanism of localization of ^{99m}Tc-sulfur colloid in bone marrow depends on regional blood flow and increased reticuloendothelial and phagocytic cell activity. Both mechanisms are felt to be involved in these cases. In fractures, hyperemia and phagocytic activity are transient phenomena and therefore the above observations may be useful in determining fracture age. (auth)

16955 THREE-DIMENSIONAL RECONSTRUCTION OF LUNG PERFUSION IMAGE WITH POSITRON DETECTION. Chesler, D. A.; Hales, C.; Hnatowich, D. J.; Hoop, B. (Massachusetts General Hospital, Boston). J. Nucl. Med.; 16: No. 1, 80-82(Jan 1975).

Transverse section images of the distribution of pulmonary perfusion in a canine were obtained using microspheres labeled with the positron-emitting isotope ^{68}Ga and a three-dimensional reconstruction technique. The reconstruction method is more accurate than conventional tomographic procedures and is facilitated by the use of positron detection. The transverse sections presented demonstrate the capacity of the technique to delineate reduction in regional perfusion resulting from occlusion of the artery to the left lower lobe. (auth)

16956 PROSTAGLANDINS IN MICE WITH NEUROBLASTOMA. Puri, S.; Belliveau, R. E.; Spencer, R. P.; Bachur, N. R. (Yale Univ., New Haven). J. Nucl. Med.; 16; No. 1, 83-85(Jan 1975).

Male albino mice, with and without transplanted neuroblastoma C1300, had tissues analyzed for prostaglandins by radioimmunoassay. Highest prostaglandin concentrations occurred in tumor tissue, lungs, spleen, and kidneys. Tritiated prostaglandins A_1 or E_1 and tritiated arachidonic acid were injected intravenously. The concentration (organ/tumor) was higher at 1 hr than at 6 or 24 hr. Prostaglandin E_1 and arachidonic acid localized principally in the kidney (likely the excretory organ) whereas prostaglandin A_1 showed highest concentration in the liver. (auth)

16957 DISPLACEMENT OF ANTERIOR CEREBRAL VESSELS IN CEREBRAL DYNAMIC STUDY IN CASES OF CHRONIC SUBDURAL HEMATOMAS. Bekier, A. (Kantonsspital, St. Gallen, Switzerland). J. Nucl. Med.; 16: No. 1, 86-88(Jan 1975).

About 75 to 80% chronic subdural hematomas give positive results in a brain scan. The typical scintigraphic finding of chronic subdural hematoma is a diffuse widening and increase of the peripheral activity on the anterior view. In the flow studies subdural hematomas lead occasionally to peripheral activity defects. In two cases of chronic subdural hematoma without typical patterns in a perfusion study as well as in static images, we found a displacement of the anterior cerebral vessels as an indirect sign of space occupation. (auth)

16958 SINUSITIS DEMONSTRATED BY BRAIN SCANNING. Soucek, C. D. (Bethany Medical Center, Kansas City, KS). J. Nucl. Med.; 16: No. 1, 89-91(Jan 1975).

Increased concentration of technetium was noted in the region of the frontal, ethmoidal, and maxillary sinuses of two patients. Radiographs of the sinuses revealed extensive sinusitis involving the sinuses in the area of increased uptake. The increased uptake was attributed to the sinusitis. (auth)

16959 INTERPRETATION OF RADIONUCLIDE LIVER IMAGES: DO TRAINING AND EXPERIENCE MAKE A DIFFERENCE? Nishiyama, H.; Lewis, J. T.; Ashare, A. B.; Saenger, E. L. (Univ. of Cincinnati). J. Nucl. Med.; 16: No. 1, 11-16 (Jan 1975).

Individual observers interpreted images in order to assess their accuracy and sources of error. Seventy-six liver images were presented to nine readers for interpretation. Readers of differing experience participated in the study: four radiology residents, three fellows in nuclear medicine, and two full-time nuclear medicine physicians. A higher incidence of false-positive reading was more common in inexperienced observers (11 to 50%) and the most correct readings were obtained by staff physicians (88% overall percentage accuracy). Heterogeneity in radionuclide uptake was the most frequently mentioned abnormality, and heterogeneity of an ill-defined nature was the most common false-positive finding in normal cases. Early stages of cirrhosis, mild hepatitis, and rare diseases such as hepatic sarcoidosis were difficult to detect. Skill of interpretation improved with experience, especially in judging heterogeneity of an ill-defined nature, and the rate of accurate readings was proportional to the level of training of the observer. (auth)

16960 ISOLATION OF LABELED THYROIDAL HORMONES (^{131}I) FROM MITOCHONDRIA AND MITOCHONDRIAL FRAGMENTS. Chobanova, D.; Rachev, R. Izv. Inst. Biokhim., Bulg. Akad. Nauk.; 4: 227-233(1973). (In Bulgarian).

The incorporation of labeled ^{131}I-thyroxine into mitochondria and mitochondrial fragments isolated from animal tissues was studied. The hormone was labelled under the usual laboratory conditions making use of an ion exchange between thyroxine and Na^{131}I. Thyroxine and its precursors were isolated as free and protein-bound compounds from mitochondria fragments of liver, kidney, brain, and heart. The iodothyronines and iodothyrosines were determined with the aid of unidimensioned ascending chromatography employing cerium sulfate for straining. The quantitative assay of the iodine containing amino acids was accomplished by determining the radioactivity of the eluates. It is established that about 90% of the total iodine containing amino acids in the examined material is due to free or weakly bound hormone. The activity is highest in the liver, approximately one and the same in the kidney and brain and lowest in the heart muscle. The rate of iodine incorporation from Na^{131}I during the interval of study (18 to 22 h. after intraperitoneally injecting the isotopes) is rather slow in comparison with that found using labelled thyroxine. (auth)

16961 DETERMINATION OF ATP-INDUCED ^{75}Ca UPTAKE IN RAT MAST CELLS. Dahlquist, R. (Kungliga Karolinska Mediko-Kirurgiska Institutet, Stockholm). Acta Pharm. Toxicol.; 35: No. 1, 1-10(1974).

Radioactively labelled calcium (^{45}Ca) was taken up into isolated rat mast cells incubated with adenosine 5′-triphosphate (ATP). This uptake did not occur in the presence of lanthanum. After a short period of incubation of the mast cells with ATP and ^{45}Ca, the addition of lanthanum markedly decreased the amounts of ^{45}Ca associated with the cells. Exchange between cellular ^{45}Ca and added unlabelled calcium in the medium was counteracted by the presence of lanthanum. It was concluded that lanthanum inhibited calcium fluxes and in addition displaced bound ^{45}Ca from sites accessible to the trivalent cation. From indirect evidence it was concluded that the ATP-induced uptake of ^{45}Ca in rat mast cells contained one component of net increase in the cellular calcium contents and one component of increased exchange of calcium. (DE)

16962 ISOLATION OF FECES AND BILE IODATE COMPOUNDS BY FILTRATION SEPHADEX G25M. Study of Entero-Hepatic Metabolism of ^{125}I-Thyroxine. Ikeda, E.; Nicolau, W.; Muramoto, E.; de Assis, L. M.; Pieroni, R. R. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Radiobiologia). Rev. Ass. Med. Brasil.; 19: No. 4, 131-136(Apr 1973). (In Portuguese).

Bile "in natura" and butanolic extract from duodenum, ileum and rectum contents were submitted to filtration through Sephadex G 25 M gel. This procedure resulted in the separation of 4 radioactive peaks. The composition of each peak was analyzed by paper chromatography. Although peak I seems to be partially composed of iodinated proteins, its actual composition has not been determined. Peaks II and III are due, respectively, to iodide and T_3 and/or T_4. The data obtained by means of paper chromatography of peak IV, after treatment with β-glucuronidase led to the assumption that it might be mainly glucuronic derivates of T_3 and/or T_4. (INIS)

16963 RELATIONSHIP OF UPTAKE OF SODIUM AND ^{45}Ca TO ATP-INDUCED HISTAMINE RELEASE FROM RAT MAST CELLS. Dahlquist, R. (Kungliga Karolinska Mediko-Kirurgiska Institutet, Stockholm). Acta Pharm. Toxicol.; 35: No. 1, 11-22 (1974).

Histamine release from isolated rat mast cells induced by extracellular adenosine 5′-triphosphate (ATP) in the presence of calcium was preceded by the uptake of sodium and ^{45}Ca in the cells. In contrast, the release induced by compound 48/80, n-decylamine and chlorpromazine was not preceded by uptake of ^{45}Ca. Histamine release and ^{45}Ca uptake by ATP were completely inhibited by p-hydroxymercuribenzoate and incubation at 0°, whereas sodium uptake was partly reduced. In the presence of 2.5 mM$-$CaCl$_2$, ATP activated the uptake of ^{45}Ca whereas, as previously reported, no sodium uptake or histamine release occurred. All three effects of ATP were inhibited by MgCl$_2$. Thus, under conditions where the uptake of either sodium or ^{45}Ca was inhibited, no histamine release was induced by extracellular ATP. Antimycin A did not inhibit ATP-induced increase in membrane permeability for sodium and calcium but completely blocked the histamine release. It is concluded that for histamine release to be induced by extracellular ATP from rat mast cells, an increased cell membrane permeability for sodium and calcium is necessary but not in itself sufficient since the release reaction is also dependent on the metabolic state of the cells. (DE)

16964 IN VITRO LABELING OF HAMSTER AND GERBIL ADRENAL CHOLESTEROL: EFFECT OF TRIAMCINOLONE ADMINISTRATION. Gans, J. H.; Alpert, M. (Univ. of Vermont, Burlington). Proc. Soc. Exp. Biol. Med.; 147: No. 3, 749-753(Dec 1974).

The cholesterol concentrations of hamster adrenal glands are 0.32 ± 0.005% wet weight confirming their classification as cholesterol-poor adrenal glands. Hamster adrenal glands incubated in vitro with [3-^{14}C]pyruvate in tracer quantities, incorporate significant amounts of ^{14}C into adrenal cholesterol. Gerbil adrenal gland cholesterol concentrations are 4.2 ± 0.28% wet weight, less than 10% of which is unesterified. The typically cholesterol-rich gerbil adrenal glands do not form ^{14}C-cholesterol when incubated in vitro with tracer quantities of [3-^{14}C]pyruvate. When incubated for 6 hr with three changes of fresh solution containing high specific radioactivity [2-^{14}C]acetate, gerbil adrenal glands form ^{14}C-labeled unesterified cholesterol, but little or none of the labeled cholesterol is esterified. The administration of triamcinolone acetonide, 0.25 mg/100 g body wt/day for 6 days to both hamsters and gerbils, results in decreased in vitro oxidative metabolism and ^{14}C-cholesterol formation by the adrenal glands of both laboratory animals. (auth)

16965 PROCEDURE FOR GRANULOKINETIC INVESTIGATION IN THE DEVELOPING BOVINE USING CHROMIUM-51. Carlson, G. P.; Kaneko, J. J. (Univ. of California, Davis). Proc. Soc. Exp. Biol. Med.; 147: No. 3, 863-867(Dec 1974).

A procedure for the study of intravascular granulocyte kinetics in the bovine utilizing chromium-51 as a cell label is described. The high degree of purity of labeled, serially isolated granulocyte fractions allows an accurate assessment of the various kinetic parameters. The procedure is applicable to the developing bovine and may be of particular importance in the evaluation of granulokinetic parameters in the critical neonatal period. (auth)

16966 RADIOACTIVE ISOTOPES IN MEDICINE AND RESEARCH. Volume 10. International Symposium Held at Bad Gastein, Austria, January 10–13, 1972. Fellinger, K.; Hoefer, R. (eds.). Sonderbaende zur Strahlentherapie, Band 72. Munich; Urban and Schwarzenberg (1973). 533p. (In Several Languages). (CONF-720126-; ISBN-3-54-05751-3). DM 150.-.

Separate abstracts were prepared for the 48 papers included. (CH)

For abstracts of individual papers see: 15926, 15927, 16126, 16138, 16843, 16844, 16905–16907, and 16967–17005.

16967 INVESTIGATIONS USING A WHOLE-BODY SCANNING SYSTEM WITH DIGITAL CONTROL AND READ-OUT. Cottrall, M. F.; Hodt, H. J.; Kent, R. W.; Trott, N. G. (Royal Marsden Hospital, Sutton, Eng.). pp 45-57 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A description is given of the construction and mode of operation of a versatile whole-body scanning system, developed for various clinical work, sometimes involving intensive study of particular patients. It provides for profile or area scanning, with digital readout into the store of a 400 channel analyzer, and can be used for measurements with low activities of radionuclides emitting gamma rays of a wide range of energies. Two 125 mm diameter ×50 mm high NaI(Tl) detectors are mounted in a chalk shielded room; lead shields up to 62 mm thick are provided for the detectors and the relative positions of shields and detectors can be varied. The patient lies on a motor driven couch which can traverse an area up to 184 × 82 cm, linear motion being continuous at speeds 1.8 to 180 cm/min or stepwise. A separate console provides controls for determining the area to be scanned, and the method of recording data. Paper tape from the analyzer is processed via a fast data link by the London University Atlas Computer; the corrected output may be presented as a scaled matrix of counts or, using a secondary output tape fed to a laboratory computer, isocount lines can be plotted automatically. In addition, from the matrix as recorded on separate occasions, the time variation of counting rate over regions selected at will can be obtained. Experimental results on phantoms show that satisfactory whole-body scans can be obtained with, for example, ^{59}Fe, using activities of less than 10 μCi. Results of some clinical studies are presented and include measurements over several weeks of the counting rate for the whole body and in the regions of the sacrum, heart, liver, and spleen in patients undergoing hematological investigations with ^{59}Fe and with ^{51}Cr labelled erythrocytes, or platelets. (auth)

16968 SHORT-TERM MEASUREMENT OF PLASMA PROTEINS CATABOLISM IN MAN. Bianchi, R.; Mariani, G.; Pilo, A. (Univ. of Pisa, Italy). pp 94-101 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Following simultaneous intravenous injection of ^{131}I-albumin and ^{125}I-sodium iodide; plasma disappearance curves of labeled albumin [P(t)] and of ^{125}I-iodide [I(t)] over a course of 12 to 24 hours are obtained by blood sampling; ^{131}I-iodide [IA(t)] released from albumin breakdown is measured in the same samples, after separation by gel filtration. The method has been applied in normal subjects and in patients; the results are found to be in good agreement with those obtained by the conventional albumin catabolism determination methods, which last at least 6 to 8 days. (CH)

16969 FUNCTIONAL EVALUATION OF ISOLATED KIDNEYS PRESERVED IN VIEW OF TRANSPLANTATION. Simultaneous Detection of ^{131}I Hippuran and ^{125}I Hypaque Curves. Pavel, D.; Kreis, H.; Assailly, J.; Bader, C.; Lacombe, M.; Funck-Brentano, J. L. (Hopital Necker, Paris). pp 102-109 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

In order to study the function of kidneys preserved for transplantation, renograms and kinetics of venous passage of ^{131}I-Hippuran and ^{125}I-Hypaque, after simultaneous injection into the renal artery of isolated pig kidneys perfused at 37°C and at different levels of hypothermia were examined. Fresh blood was perfused for 5 to 7 hours. During the first minutes after injection of ^{131}I-Hippuran and ^{125}I-Hypaque, the circuit was kept open to avoid any recirculation. Blood flow, temperature, pH, arterial and venous pO^2, urine volume, and sodium excretion were all monitored. At 37°C the renal curves obtained with hippuran and with hypaque after simultaneous injection are completely different, mainly at the initial portion. The ratio of the height of the plateau to the maximum peak height suggests a hippuran retention of about 85 to 95%, whereas the hypaque retention is about 10–20%. At 5°C the 2 curves become completely superimposed. When the temperature is raised towards the initial value, dissociation of the two curves reappears. Hypothermia alters the tubular uptake of hippuran reversibly. The evolution of the curves is independent of urinary output and blood flow. The curves registered at the venous outlet confirmed the observations obtained from the kidney tracings. The spectrum of transit times could be directly and easily calculated from the renogram curves, registered without recirculation of tracers. The information obtained by this technique may have a valuable place in the evaluation of functional capacity of kidneys placed in preservation machines before transplantation. (auth)

16970 COMPARATIVE STUDY OF THE ISOTOPIC FUNCTIONAL EXPLORATION AND THE HISTOLOGY OF THE KIDNEYS OF DOGS WITH TRANSPLANTS. Grenier, J. F.; Methlin, G.; Grob, J. C.; Jaeck, D.; Stock, C.; Botescu, V. (Hopital Civil, Strasbourg). pp 110-118 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Comparative studies were made of the fixation and renal excretion of ^{131}I-labeled Hippuran and mercuric chloride (Hg-197-Cl$_2$) in two series of dogs undergoing various types of renal transplantation. Isotopic tests before transplantation and at 1, 3, 6, and 10 week intervals were compared with histological findings. It is concluded that there is good correlation between the two types of investigation. (auth)

16971 TUBULAR AND GLOMERULAR CLEARANCE AND SEQUENTIAL SCINTIGRAPHY IN TRANSPLANTED KIDNEYS. Pfeifer, K. J.; Rothe, R.; Richert, J.; Klinger, W.; Heinze, H. G. (Univ., Munich). pp 119-124 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Sequential scintigraphic examinations were carried out in 17 patients following renal transplantation. Hippuran ^{131}I and ytterbium-169-EDTA were used, in order to measure the effective renal plasma flow and glomerular filtration rate. The results are discussed and illustrated by examples. (auth)

16972 COMPARATIVE STUDIES ON LATERALLY SEPARATE RENAL BLOOD DETERMINATION WITH ^{133}Xe INHALATION. Schmitz-Feuerhake, I.; Froehlich, H.; Pixberg, H. U.; Taegder, K. (Medizinische Hochschule, Hanover). pp 125-131 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Most studies of renal blood flow are carried out by injecting a solution containing ^{133}Xe directly into the renal artery. However, since it is possible to study cerebral blood flow by inhalation of the tracer, an attempt was made to apply similar techniques to renal blood flow studies. Radioactivity curves were, therefore, recorded over the kidneys. These curves could be resolved into three components of which the first represents blood flow in the renal cortex. The whole investigation takes about 10 to 15 minutes, and calculation can be carried out by an analogue computer. The results obtained by this method were compared with blood flow measurements derived from ^{131}I hippuran clearance. Good agreement was obtained between the two methods. (auth)

16973 QUANTITATIVE MEASUREMENT OF THE RENAL ACTIVITIES BY THE SCINTIGRAPHIC METHOD. Schoutens, A. (Hopital Univ. Brugmann, Brussels); Durdu, J.; Erbsmann, F. pp 132-140 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A model was used to study errors that stem from external measurements of renal radioactivity using scintigraphic techniques. Parameters that are of particular significance are the γ energy of the tracer used, the width of the model, the depth of the kidneys, and activity due to diffusion from contralateral sources. The results of studies using ^{197}Hg as tracer show that the relative error remains small when the geometric mean of prone and supine counts is used and when care is taken to make measurements in the appropriate energy range of the tracer. (auth)

16974 CLINICAL RESULTS OF ANGIOSCINTIGRAPHY OF THE KIDNEYS. Haas, J. P.; Claus, H. G. (Univ., Mainz). pp 141-147 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

In several hundred kidneys, angiography was combined with angioscintigraphy ^{131}I-MAA. In most of the cases, scintigraphy following the i.v. injection of ^{99m}Tc-iron complex was also used. In addition to normal subjects, a wide variety of renal pathological conditions was studied (e.g., tumors, cysts, tuberculosis, renal artery stenosis). In individual cases, it was possible to obtain meaningful information. An attempt was made to assess the efficiency of the technique and to work out its clinical usefulness. It is concluded that the technique represents a new approach to diagnostic difficulties. False positive results and diagnostic failures were mostly due to technical reasons. (auth)

16975 SELECTIVE RENAL PERFUSION SCINTIGRAPHY WITH ^{99m}Tc, AND EXPANSION OF ANGIOGRAPHIC RENAL DIAGNOSIS. Heidenreich, P.; Mutzenbach, P.; Hoer, G.; Kempken, K.; Weib, H. D. (Univ., Munich). pp 148-157 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

In 25 patients, renal arteriography (Seldinger technique) and selective renal perfusion with ^{99m}Tc (pertechnetate) was carried out in patients where there was clinical indication for the renal arteriography. The tracer was rapidly injected through an arterial catheter. Gamma camera pictures were taken at 2.5 sec intervals; at the same time the data were fed into a multi-channel analyzer and recorded on magnetic tape. Regions of interest were selected and expressed as time-activity curves. Renal angiography (^{131}I-MAA) only gave a static picture of the intrarenal blood flow distribution within the capillaries, whereas the use of a gamma camera provides quantitative information regarding perfusion dynamics. The portion of the ^{99m}Tc perfusion curve from the first 15 secs after injection permits the calculation of the mean transit time. This parameter was significantly prolonged by arteriosclerotic conditions as compared with normal kidneys. It is suggested that there is a relationship between the mean renal transit time for ^{99m}Tc and the renal cortex vascular volume. It would appear that the value of renal arteriography can be increased by this technique. (auth)

16976 HEPATIC SCINTIGRAPHY WITH ^{75}Se SODIUM SELENITE AND ^{198}Au COLLOIDAL GOLD FOR THE DIAGNOSIS OF NEOPLASTIC LESIONS. Mombelli, L.; Meldolesi, U. (Univ., Milan). pp 158-163 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A method is proposed to demonstrate neoplastic lesions of the liver by scanning using ^{75}Se sodium selenite, which accumulates in many malignant tumors. Since sodium selenite is also taken up by normal hepatic tissue, a scintigraphic demonstration of neoplastic areas can be obtained only by a dual-channel technique, by means of which the contribution of the radioactivity in normal tissue is subtracted. Radioselenite is injected intravenously in patients in which liver defects are demonstrated by scanning with ^{198}Au-colloidal gold. After 24 hours, a dual-channel scan is performed, taking advantage of the radiogold which is still present in the liver: One channel detects the 280 keV photopeak of radioselenium and the other the 411 keV photopeak of radiogold. The two count-rates are approximately equalized and the ^{198}Au output is then placed in a subtraction mode. In this way a demonstration is obtained of those lesions which only concentrate radioselenium, while either the normal parenchyma or the lesions which do not take up selenite will not appear. More than 150 patients have been studied by this method and the results obtained are discussed. (auth)

16977 CONTROL OF SCINTIGRAPHIC AND TOMOSCINTIGRAPHIC LIVER DIAGNOSIS WITH ULTRASONIC TOMOGRAPHY. Huenig, R.; Walther, E.; Kinser, J. (Univ., Bern). pp 164-175 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The diagnosis of topographical abnormalities and their differentiation from other pathological lesions of the liver presents difficulties in conventional radionuclide liver scanning. In particular, deep seated lesions are very difficult to demonstrate. However, rational therapeutic measures cannot be undertaken as long as the diagnosis remains unclear. One approach to these problems has been to combine ultrasonic tomography with ^{99m}Tc and ^{198}Au-colloids tomographic scintigraphy using a gamma camera. This procedure has led to improvements in diagnosis. (auth)

16978 SCINTIGRAPHIC DEFECTS IN THE LIVER AND ITS ANGIOGRAPHIC CORRELATE: AN ANALYSIS OF 72 VERIFIED CASES. Umek, H.; Czembirek, H.; Imhof, H.; Pokieser, H. (Medizinische Univ., Vienna). pp 176-182 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From tenth international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Seventy-two cases of liver disease were studied in which the diagnosis had been established by scintigraphy and angiography. Conditions included cirrhosis, hepatoma, liver metastases and echinococcus cysts. Angiographic investigations were carried out using the Seldinger method, liver scintigraphy with a γ camera and ^{99m}Tc sulphur colloid. The relative advantages and disadvantages of both methods are discussed together with some conclusions regarding their clinical usefulness. (auth)

16979 DIAGNOSTIC VALUE OF LIVER SCAN IN OPERATED ECHINOCOCCUS CYST. Nezam-Mafi, S.; Ghasseminejad, A. (Univ. of Tehran, Iran). pp 183-187 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The high accuracy of liver scanning in space occupying lesions of the liver has been repeatedly proven. Many works have shown that the size, location, and number of the echinococcus cysts could also be predicted. What is less clear is the value of postoperative scanning in these cysts. Twenty patients with proven echinococcus cysts were followed for a period of 6 to 24 months by ^{198}Au-colloid post-operative scan. From our results it appears that there is a minimum of 14 months for the image to become stabilized, and although there is a definite regression of the cold areas in all scans, a residual defect remains, and one could not differentiate between a postoperative scar and a persistent cyst clearly. Possible ways of increasing the accuracy of this diagnosis are discussed. (auth)

16980 DETERMINATION OF THE FLOW OF A CEPHALORECHIDIAN LIQUID SHUNT FOR HYDROCEPHALIA BY ISOTOPIC VENTRICULOGRAPHY. Akerman, M.; de Tovar, G.; Koutoulidis, C.; Guiot, G. (Hopital Foch, Suresnes, France). pp 188-202 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A method for studies of hydrocephalus which can provide quantitative results on a routine basis is described. Following the injection of ^{131}I human serum albumin into the ventricles, it is possible to calculate an index of removal of the tracer that is calculated from two parameters. These are the rate of removal of radioactivity from the ventricles and their volume as determined by planimetry from the scans. Approximately 40 examinations of the type described above were made using scanning or a γ camera and multi-channel analyzer. (auth)

16981 HOW MUCH RADIOACTIVITY REACHES THE BASAL CISTERNS AT CISTERNOGRAPHY? Soederborg, B.; Lying-Tunell, U. (Soedersjukhuset, Stockholm). pp 203-207 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

An earlier published method for calculating the washout of ^{131}I–HSA from the region of the basal cisterns after lumbar intrathecal injection is described. A stationary detector system was used and corrections were made for room and tissue background. In the region of the basal cisterns, the activity decreased exponentially and a biological half-life could be calculated. This paper deals with the amount of activity reaching the basal cisterns. As a consequence of the exponential decrease, the upper limit was determined by the extrapolated value at the time of injection. The relation between count-rate and activity was determined with the aid of phantom measurements. Results showed that only a minor part of the injected material reached the measured region of the basal cisterns. Using a modified technique of injection, more activity, but still generally a minor proportion, reached the basal cisterns. (auth)

16982 ^{131}I–HIPPURAN IN THE PROGNOSIS AND TREATMENT OF HYDROCEPHALIA. Knoetgen, I.; Fueger, G. F.; Gell, G. (Univ., Graz). pp 213-223 of Radioactive Isotopes in Clinic and

Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Hippurate labeled with ^{131}I was injected into a lateral cerebral ventricle in 60 hydrocephalic children. Concomitantly, intracranial pressure was measured. The time course of radioactivity was followed by external counting over the head, the chest and the urinary bladder. The data obtained demonstrated the extent of transfer of the radiopharmaceutical from the cerebral ventricles into the body at large. Good agreement was found between CSF pressure, radiohippurate transfer, and the natural development of hydrocephalus. Increased pressure and lack of transfer was associated with obstructive hydrocephalus of the communicating and non-communicating type, requiring surgical intervention. Increased pressure and adequate transfer were found in patients, indicating an overproduction of CSF. In some patients the hypersecretory nature of their hydrocephalus responded well to conservative treatment, so that surgical intervention could be avoided. Normal intracranial pressure and adequate transfer of radiohippurate was found in certain patients with increased ventricular size, indicating a compensated state of hydrocephalus. From the clinical studies the assumption is made that in infants the lining ependyma of the cerebral ventricles plays an important role in the removal of cerebrospinal fluid, and that ^{131}I hippurate serves as useful indicator of this process in small children. (auth)

16983 CAPACITY TEST OF THE SPLEEN, AN EXAMPLE FOR THE FUNCTIONAL TEST OF THE RES. Gamm, H.; Fischer, J.; Wolf, R. (Univ., Mainz). pp 224-231 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Functional studies of the spleen have been carried out over the last few years using heat denatured ^{51}Cr-labelled erythrocytes (HTE). As a test of spleen function the sequestration index has been used. This shows the percentage of injected ^{51}Cr labelled HTE removed from the blood by the spleen. Normally, this is 60 to 75%. However, in many pathological conditions a reduced sequestration index is found after a test dose of 4 to 5 ml HTE. In other tests, where the clinical condition suggested abnormal spleen function, the results were normal. This was found in many cases of splenomegaly, but this might be explained by a compensatory hypertrophy despite a reduced capacity for HTE. The purpose of further tests was an attempt to express splenic function in terms of a reserve capacity for HTE. To carry out the test, a series of doses of HTE was given in the following sequence: at first a small dose of ^{51}Cr HTE (5 ml), followed by a larger dose of unlabelled HTE (10 to 20 ml); this process was repeated for not more than four times. The sequestration index shows at which stage the splenic capacity for erythrocyte sequestration is exhausted. Indications for this test are when splenic involvement is suspected, but the results of the first test are normal. Results are presented for various conditions in 65 patients. (auth)

16984 LYSOZYME EFFECT ON CYTOMORPHOLOGY, PROLIFERATION KINETICS, AND ^{198}Au INCORPORATION OF TUMOR CELLS. Chone, B. (Univ., Heidelberg). pp 238-242 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The effect of lysozyme plus colloidal ^{198}Au on the characteristics of tumor cells in pleural and peritoneal metastases has been examined both in vitro and in vivo. Under in vivo conditions there appeared to be an increase in the uptake of the radiocolloid (3 to 7 times as compared with the in vitro situation). The in vitro experiments showed that lysozyme increased phagocytosis in the tumor cells. These changes seem to be associated with cell membrane destruction and degeneration, the uptake of the colloid being a passive process. It also appeared to affect the proliferation kinetics of the cells as judged by ^{3}H thymidine incorporation. Use of lysozyme in conjunction with colloidal ^{198}Au is useful especially since lysozyme appears to be non-toxic. (auth)

16985 GAMMA ANGIOCARDIOGRAPHY WITH MEASUREMENT OF THE CARDIAC CAVITY VOLUME AND PULMONARY VASCULAR CHANNEL. Determination of Transit Times. Floyrac, R.; Itti, R.; Planiol, T.; Floyrac, G. (Centre Hospitalier Regional Bretonneau, Tours, France). pp 281-289 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The quantity of radioactivity associated with an embolus within the left and right cardiac chambers and both lungs can be followed by means of a scintillation camera following the administration of ^{99m}Tc-technetium. The curve obtained from a zone of interest plus the total activity within the thoracic organs is usually at a plateau for about 5 seconds. This permits measurements under the same conditions of geometry and sensitivity of the total administered radioactivity and different fractions of distribution. This technique enables all the parameters obtained by classical radiocardiography to be obtained. Mathematical analysis is carried out by convolution and the Laplace transformation, which permits the determination of transit time in the various compartments and, in particular, the pulmonary vascular bed. It is not necessary to construct a hypothesis regarding the transit of the radioactive embolus. A single intravenous injection is all that is necessary to determine a large number of parameters. (auth)

16986 METHOD FOR DIAGNOSIS OF INTRACARDIAC SHUNTS BASED ON RADIOISOTOPE ANGIOGRAPHY. Bosnjakovic, V. B.; Bennet, L. R.; Vincent, W.; Newton, C. (Univ. of Belgrade). pp 290-300 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Visualization techniques of the cardiac chambers by radioisotope angiography have frequently proven inadequate for diagnosis of intracardiac shunts, particularly left-to-right shunts. The method described supplements visualization techniques with analog time-activity curves obtained over the cardiac chambers, and the use of two radiotracers injected in sequence. Xenon-133 in saline is used to delineate venous blood flow, while ^{99m} technetium (sulfur colloid) outlines all chambers. Visual information from a gamma scintillation camera placed precordially in a modified left anterior oblique position is stored on the magnetic video-tape. Simultaneous time-activity curves obtained from regions-of-interest selected over the two matched heart chambers, such as both atria or ventricle are obtained during the replay of the tape. The hemodynamic patterns of the time-activity curve characteristic for the normal circulation, right-to-left or left-to-right shunts, are developed. Forty patients (mostly pediatric) with proven diagnosis were studied: 11 normal, 6 right-to-left and 23 left-to-right shunts. In all but 3 cases with small left-to-right shunts, the result was consistent with catheterization and contrast angiography studies. Without using cardiac catheterization, the method is capable of diagnosing right-to-left and left-to-right shunts, of discriminating their existence on either the atrial or ventricular level, and, by using ^{99m}Tc HSA or ^{113m}In, of quantitating shunts. (auth)

16987 SCINTIGRAPHY OF THE MYOCARDIUM WITH ^{131}Cs. Experimental and Clinical Study. Burguet, W.; Merchie, G. (Univ., Liege). pp 301-309 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF1720126-.

Studies of the blood clearance of ^{131}Cs and its tissue uptake were made in dogs. Plasma disappearance is very rapid and fixation by the left ventricle appears to be preferential. The heart-blood ratio after 3 hours is 150 : 1. Cardiac scans have been carried out in human subjects with cardiac disease and have been found to be useful in the investigation of patients with myocardial infarction including a patient with a pace maker. In a neoplastic condition of the pericardium there was fixation of the Cs in a primary tumor of the lung. Fixation of Cs in other lung tumors was observed repeatedly. (auth)

16988 RADIOCARDIOGRAPHIC STUDIES WITH DIGITALIS. Leb, G.; Klein, W.; Eber, O. (Univ., Graz). pp 310-315 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The clinical pharmacology of cardiac glycosides was studied using ^{51}Cr-erythrocytes and ^{131}I-human serum albumin scanning techniques to obtain various hemodynamic indices. These investigations were carried out in 42 patients with decompensated left heart failure. Measurements were made of cardiac output, various phases of the cardiac cycle, and changes in stroke volume. The effects of the glycoside under test were observed by scanning two hours after oral administration or intravenous injection. In order to calculate the ventricular volume from measured curves, a multichannel analyzer and data processing (UNIVAC 494) was used. The glycosides used were K-Strophanthin, Lanatoside C, Digoxin, Alpha-acetyl-digoxin, Beta-acetyl-digoxin and Beta-methyl-digoxin. Using a combination of the methods mentioned, above information can be obtained regarding the cardiac external workload and contractile state of the myocardium under the influence of the various glycosides and their route of administration. By the intravenous route, the greatest rise in contractility was obtained with strophanthin. For glysosides orally given, β-acetyl-digoxin showed the strongest effect. The pharmacologic effects of i.v. injection occurred between 15 to 30 minutes after injection and strophanthin showed these effects earlier than the other glycosides. Orally administered glycosides showed their effects earliest in the substituted digoxin derivatives. (auth)

16989 SODIUM AND WATER SPACE IN PATIENTS ON THE HEART LUNG MACHINE. Henegar, G. C.; Anagnostopoulos, L.; Brandly, J. M.; DeBoer, A.; Fritsch, B. A.; Stefanovic, N. (VA Hospitals, Hines, IL). pp 316-320 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Radioisotopes permit measurements of multiple fluid and electrolyte compartments simultaneously, therefore, dynamic changes in these compartments may be studied under various conditions. The patient on the heart-lung machine for open heart surgery presents several unique problems. If whole blood is used as a pump primer, acidosis may develop. If lactated Ringers solution is used as the blood dilutent in priming the pump, edema may develop. This study was carried out to quantitate the effects of the sodium and water contained in the lactated Ringer's solution on the patient's total body sodium and water. Total body sodium was measured with ^{22}Na and total body water with $^{3}H_2O$. The studies were done simultaneously preoperatively, immediately postoperatively and 3 to 6 weeks postoperatively. Immediately postoperatively, there was a 24.6% increase in total body sodium and a 17.1% increase in total body water. In the long term follow-up studies, there was a return to approximately the preoperative levels. These data indicate that the sodium and water retentions are commensurate with the intake. A better solution for hemodilution is indicated. (auth)

16990 EVALUATION OF REGIONAL LUNG FUNCTION WITH ^{133}Xe. MacIntyre, W. J.; Inkley, S. R. (Case Western Reserve Univ. School of Medicine, Cleveland). pp 321-334 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

It has been pointed out that the washout of ^{133}Xe following intravenous injection of the dissolved gas provides information primarily concerning the ventilation of perfused alveoli. Since the slope of the washout curve represents the fraction of Xe cleared per unit time, the product of the slope multiplied by the amount of gas present in the alveoli by perfusion would then represent the total amount of gas cleared per unit time. By the same method, the relative contribution of each region of the lung to total gas exchange may be calculated by using the characteristic slope of each region and multiplying by the fraction of the total dose perfusing that element. By means of a scintillation camera and computer analysis, regional gas exchange values were calculated for the entire lung field and displayed both as a 40 × 40 matrix as well as a three-dimensional plot with the Z-axis representing the variation of the gas exchange parameter for each of the 1600 regions. This display of the product of the two variables has permitted an easy and accurate delineation and assessment of poorly functioning regions of the lung, while examination of the individual matrices can determine whether the reduced function is due to an abnormal perfusion or to a slow clearance. In a similar sense, the individual slope value divided by the perfusion per unit volume can show if the alveolar ventilation is or is not matched to the relative perfusion of that region. (auth)

16991 A "BAG IN BOX" SYSTEM IN REGIONAL VENTILATION STUDIES OF THE LUNG WITH XENON-133. Peset, R.; Beekhuis, H.; Tammeling, G. J.; Vaalburg, W.; Woldring, M. G. (Univ. Hospital, Groningen, Netherlands). pp 335-343 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The use of ^{133}Xe in a closed spirometer system introduces several systematic errors in lung ventilation studies. This is caused by the high solubility of the Xe gas and by the fact that the concentration of the inspired gas is not constant during the investigation. Correction for the error due to the solubility falls out of the scope of the clinical use of ^{133}Xe. The error due to the variable concentration of the inspired gas can be eliminated by using an open spirometer system. This is achieved by means of a modified bag-in-box system, in which the patient inspires from the box and expires into the bag. Because of the relatively large amount of ^{133}Xe in the bag-in-box system in comparison to the small amount used in a closed system, a Xe recovery equipment has been developed: the Xe is adsorbed to charcoal at −80°C and eluted at +60°C. The ventilation studies are performed with a 12 detector apparatus (6 detectors anterior and 6 detectors posterior). With the help of a computer program, the digital results are plotted in 12 graphs in the same pattern as the position of the detectors on the patient, so that the results can be interpreted visually in an easy way. With this program several indices derived from these experiments are calculated for each of the 12 fields. Technical data on equipment and analysis as well as results in patients are given. (auth)

16992 DIAGNOSIS OF BRONCHIAL CARCINOMA IN THE COMBINED ^{133}Xe/MAA LUNG SCINTIGRAM: RESULTS OF RETROSPECTIVE AND PROSPECTIVE STUDIES. Roesler, H.; Schnaars, P.; Kinser, J.; Baumann, H. R.; Baumgartner, M.; Hoffmann, W.; Zuppinger, A. (Univ., Bern). pp 344-350 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The lung perfusion scintigrams with ^{99m}Tc- or ^{131}I-MAA are routinely supplemented with a perfusion/exhalation scintigraphic series with intravenously injected ^{133}Xe in saline. This technique is within the scope of a standard nuclear medicine department and, using wash-out curves, gives a quantitative measure of lung function, expressed in terms of lung physiology, as well as a qualitative survey of regional pathology. Out of more than 1200 consecutively examined patients, 56 with untreated, proven bronchial carcinoma were chosen for the retrospective study and showed unilocular perfusion defects in all and a regional Xe trapping in 87% of those with centrally located tumors. This trapping enables the differentiation of the unilocular defect caused by lung embolus from that caused by tumor. Bronchial obstruction due to other causes, such as emphysema and chronic bronchitis, appears multilocularly more often than unilocularly and is further distinguishable by the evaluation of the other simultaneously measured parameters of respiratory function. In the prospective study, 218 patients were examined as a pilot group for the earlier recognition of lung cancer. This was scintigraphically suspected in 77 patients. Up to the end of this study, the suspicion was confirmed in 37 (48%) and ruled out in 20 (26%). In 141 of these 218 patients, there was no scintigraphic evidence of bronchial carcinoma. In 98 (70%) the negative finding was confirmed through further observation. However, in 8 patients (6%) a bronchial carcinoma was found during the further investigations within three months after scintigraphy. (auth)

16993 REGIONAL LUNG FUNCTION (^{133}Xe-RADIOSPIROMETRY) IN BRONCHIAL CANCER. Arborelius, M. Jr.; Kristersson, S.; Lindell, L.; Lindell, S. E.; Mioerner, G.; Svanberg, L. (Malmoe General Hospital, Sweden). pp 351-355 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

In bronchial cancer, studies of regional lung perfusion and ventilation with ^{133}Xe may be used to localize roentgenologically occult cancer; to judge invasiveness, i.e., operability and long-term prognosis; and to estimate postoperative lung function. The investigation is atraumatic, with a low radiation dose. Hence, it should be used at an early stage in the preoperative evaluation. (auth)

16994 USE OF COMBINED INHALATION AND PERFUSSION STUDIES WITH ^{133}Xe FOR CLARIFICATION OF OPERABILITY IN BRONCHOCARCINOMA AND FOR THE CONTROL OF THE IRRADIATION CONSEQUENCES. Locher, J. T.; Hofer, B. J.; Sauer, R. (Univ., Basel). pp 356-364 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Xenon-133 does not impose any inconvenience to patients and is suitable for ventilation and perfusion studies of the lung. Recordings of serial scintigraphy with a gamma camera are helpful in obtaining functional parameters (regional activity concentration, Xe washout etc.) and to make a quantitative assessment of regional lung function. In this way, a better understanding of prognosis, surgical hazards, and the postoperative respiratory situation is possible. It also allows quantitative control of radiation therapy in bronchocarcinoma. Thus far, 50 patients with inoperable bronchocarcinoma have been examined by a combination of ^{133}Xe inhalation and perfusion. (auth)

16995 USE OF GERMANIUM SEMICONDUCTOR DETECTORS FOR IN VIVO MEASUREMENTS. X-Ray Fluorescent Thyroid Scanning. Determination of the Depth Distribution of Radioactivity. de Bruin, M. (Interuniversity Reactor Institute, Delft, Netherlands). pp 389-395 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

This paper deals with two possible applications of plane thin window lithium drifted germanium semiconductor detectors to in vivo measurements in medicine. Such a detector has been used in fluorescent thyroid scanning. In the described system, only the radiation source is collimated and the entire area of the detector is available for detecting the fluorescence x-rays. The features of the system, which are discussed, include the thyroid dose resulting from a fluorescent scan, the spatial resolution of the system and the possibility of a quantitative interpretation of the data. A germanium semiconductor detector can also be of use for the determination of the depth distribution of radioactivity. If an isotope emits photons of two or more different energies, the measured intensity ratios contain information about the thickness of any absorbing material between the source and the detector. When using a thin window semiconductor detector, sensitive depth determinations become possible when measuring intensity ratios of x-ray/gamma ray pairs emitted by a single isotope. The appraisal of this technique is demonstrated by two examples. (auth)

16996 TWO METHODS FOR IMPROVING SECTION SCANNING. Todd-Pokropek, A. E. (Middlesex Hospital Medical School, London). pp 396-401 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Section scanning using either scanners or γ cameras is currently being used by a number of centres. The problems of reconstruction of the original image from its projections is not trivial. A previous paper suggested a number of modifications to the digital technique originally suggested by Kuhl. Two rather more radical techniques are explained in this paper. The first is a method using random placings of counts so as to satisfy exactly each individual projection. The second is to correct for the known blurring introduced by Kuhl's technique by using an inverse filter. The problem with the first technique is noise and the computer time involved. The second technique is relatively quick, but can generate some oscillations. An example of the reconstruction of a point source is shown. (auth)

16997 ^{131}Ba: A NEW NUCLIDE FOR BONE SCINTIGRAPHY. First Clinical Result. Mahlstedt, J.; Prignitz, I.; Joseph, K. (Philipps-Univ., Marburg, Ger.). pp 402-406 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The advantages of ^{131}Ba for bone scanning are discussed. Since this nuclide has a longer physical half life than ^{18}F or ^{87m}Sr, it can be held in stock ready for use whenever required. Plasma clearance is more rapid than strontium and a good quality scan can be obtained 2 hours after injection. It is suitable for use with either a conventional scanner or a γ camera. (auth)

16998 EFFECT OF ADDITIVES IN XENON-133 INJECTION. Lovett, D. E. (Radiochemical Centre Ltd., Buckingham, Eng.); Peacegood, J. A.; Reeve, J.; Veall, N.; Winsley, B. E. pp 431-438 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The unsuitability of established bactericides for use in ^{133}Xe injection solutions was shown. Multidose injection peaks of ^{133}Xe containing 0.3% e-phenylethanol are stable to radiolysis and demonstrate antimicrobial efficiency against a wide spectrum of microorganisms. A slight vasodilation effect is observed when this solution is injected interstitially for resting muscle blood flow measurements. This effect is only transient and necessitates simply waiting 5 minutes before recording the slope of the clearance curve. On the other hand, 2-phenylethanol appears to exert a protective effect against the formation of pain producing vasoactive substances in ^{133}Xe solution, which under some conditions may be formed as a result of radiolysis. (auth)

16999 AUTOMATION OF RADIOIMMUNOLOGICAL DETERMINATION OF INSULIN. Ingrand, J.; Laverlochere, J.; Linhart, N.; Roucayrol, J. C. (Hopital Cochin, Paris). pp 439-445 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

An automated method for the radioimmunoassay of plasma insulin is described and its advantages are discussed. Instead of the double antibody technique, adsorption of free hormone by talc is used. Simple electrical and mechanical parts form part of the apparatus used. Reproductivity is good with very little cross contamination between successive analyses. (auth)

17000 DETERMINATION OF THYROID WEIGHT USING SCINTIGRAPHY AND ULTRASONIC TOMOGRAPHY. Huelse, R.; Hahn, K.; Wolf, R. (Univ., Mainz). pp 454-457 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

By using ^{131}I scintiscans and ultrasonic tomography, it is possible to make accurate measurements of the length, breadth, and depth of the thyroid gland and to calculate with adequate accuracy the volume of the organ. Measurements were made on 22 thyroid glands in cadavers in order to validate the method. Good correlation was obtained between direct measurements and those obtained by the ultrasonic technique. (auth)

17001 IDENTIFICATION OF JEJUNAL INTERFERENCE IN PANCREATIC SCANNING BY COMBINED PHOTOSCINTIGRAPHIC AND X-RAYS STUDIES. Favino, A.; Caprotti, M.; Scarabelli, L.; Padolfi, U. (Univ., Pavia, Italy). pp 463-471 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Evaluation of radioselenomethionine uptake is reported in 70 cases (30 out of them submitted to surgery) studied by pancreas photoscintigraphy, carried out by ^{198}Au–^{75}Selenomethionine electronic image subtraction technique. Jejunal uptake, together with, but distinct from intestinal uptake, becomes evident in cases where pancreatic amino acid uptake is decreased by regional or diffuse pathological processes. Scintigraphic morphology is complicated, consequently, in the region of the tail, or, as in cases of mesenterium commune, in the region of the head of the gland. A method is presented for detecting jejunal interference by superimposition of pancreas photoscintigrams and of opaque gastro-duodenal-jejunal tract x-ray pictures obtained in homogeneous and comparable protective conditions. Details of the method are presented. The sequence of the method was worked out on a phantom. Some factors affecting photoscintigraphic outline of the pancreatic gland are discussed. Clinical applications of the method are presented in the interpretation of combined radiographic and scintigraphic findings in patients with a normal pancreas and in patients with congenital or acquired jejunal abnormalities or bearing intestinal and pancreatic anatomical modifications due to surgical operations. (auth)

17002 DIAGNOSIS OF PARATHYROID ADENOMAS BY RADIOISOTOPIC EXPLORATION. Bischof-Delaloye, A.; Delaloye, B. (Hopital Cantonal Univ., Lausanne, Switzerland). pp 472-478 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In German)

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Parathyroid scanning has been carried out by means of ^{75}Se-methionine and ^{99m}Tc (pertechnetate) combined with a subtraction technique which precisely delineates areas showing increased uptake of ^{75}Se. Stimulation by means of intramuscular glucagon has also been used. The apparatus was a γ camera with data processing by a PDP 8. A total of 106 patients were investigated in this way and

15 of these were operated and are presented. Results show that 8 times a parathyroid adenoma was correctly diagnosed. The results are discussed with relevance to findings in various conditions together with diagnostic difficulties, causes of error, and the necessity of taking clinical and biological factors into account. (auth)

17003 ^{67}Ga, ^{111}In, AND ^{75}Se IN TUMOR SCINTIGRAPHY. Rasmussen, J. W.; Frederiksen, P. B.; Kalnaes, O. (Radiumstation, Odense, Denmark). pp 485–491 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

Forty-eight patients with malignant tumors were investigated by scintiscanning with ^{75}Se, 67 patients with ^{67}Ga, and 12 patients with ^{111}In, and ^{75}Se showed 66% correct positives, ^{67}Ga showed 76% correct positives, and ^{111}In 5 correct positives out of 12. Gallium-67 gave the most distinct representation, but in many ways, ^{67}Ga and ^{75}Se scintigrams were of equal quality. The quality of the ^{111}In scintigrams was inferior to ^{67}Ga and ^{75}Se. (auth)

17004 ^{67}Ga-SCINTIGRAPHY OF MALIGNANT TUMORS. Fogh, J.; Edeling, C. J. (University Hospital of Copenhagen). pp 492–503 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

A total of 253 patients suspected of focal pathological lesions in a number of organs were examined by ^{67}Ga-scintigraphy. When all investigations had been concluded, 200 pathological lesions had been verified by histological or bacteriological examination. Accumulation of ^{67}Ga was observed in 118 malignant and 18 benign lesions (diagnostic specificity 87%) and no accumulation in 47 benign and 18 malignant lesions (diagnostic sensitivity 73%). In a number of cases, ^{67}Ga-scintigraphy revealed malignant tumors or metastases which had not otherwise been discovered. In most cases of ^{67}Ga-accumulation in non-malignant lesions, other preoperative examinations proved that the lesions were benign. It was concluded that ^{67}Ga-scintigraphy constitutes in many cases a valuable supplement to the other methods used in the diagnosis of malignant diseases. (auth)

17005 DIAGNOSIS OF MALIGNANT TUMORS AND THEIR DIMENSIONS BY ^{57}Co-LABELLED BLEOMYCINE. Nouel, J. P. (Centre Henri Becquerel, Rouen); Robert, J.; Witz, H.; Mammo, L.; Gest, J.; Gailliard, P.; Desgrez, A.; Vergnes, R.; Bru, A.; Renault, H. pp 504-512 of Radioactive Isotopes in Clinic and Research. Vol. 10. Fellinger, K. (Ed.). Munich; Urban and Schwarzenberg (1973). (In French).

From 10th international symposium on radioactive isotopes in clinic and research; Bad Gastein, Austria (10 Jan 1972). See CONF-720126-.

The effectiveness of ^{57}Co-bleomycin scintiscanning for the localization of primary neoplasms and metastases was demonstrated in a series of 100 patients. (CH)

MATERIALS

17006 (AD-779076) LOW TEMPERATURE PROPERTIES OF THE ONE DIMENSIONAL POLARON BAND. I. Extreme Band Narrowing Regime. Beni, G.; Pincus, P.; Kanamori, J. (California Univ., Los Angeles (USA). Dept. of Physics). Dec 1973. Contract N00014-69-A-0200-4032. 21p. NTIS $3.00.

A narrow one dimensional tight binding chain with intra-atomic coulomb repulsions described in the hubbard model is considered. The electrons at each site are furthermore assumed coupled to a high frequency local oscillator. In the limit, where the oscillator frequency is large compared with the bandwidth and in the extreme band narrowing regime, for various electron densities, it was found that: half-filled band ground state is an antiferromagnetic insulator; one-third filled band is a diamagnetic insulator; one-quarter filled band is a weakly coupled system of bound singlet pairs somewhat reminiscent of superconductivity. (GRA)

17007 (BARC-768, pp 11-23) STUDIES IN MOESSBAUER SPECTROSCOPY. Rao, K. R. P. M. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

Applications of the Moessbauer effect technique in solid state physics are given, and the feasibility of utilization of the technique as a nondestructive testing tool for metallurgical applications in technology and industry is indicated. (LK)

17008 (RN-S-0451) NERVA MATERIALS DEVELOPMENTS FIRST QUARTER, CONTRACT YEAR 1968 (1 OCTOBER–31 DECEMBER). (Aerojet-General Corp., Sacramento, Calif. (USA)). Feb 1968. 92p. Dep. NTIS $7.75.

Topics include materials investigations related to wear and friction, radiation damage, space environment, and activities in support of engine components and of facilities at both AGC, Sacramento, and NRDS, Nevada. (30 fig, 14 tables) (auth)

17009 (TRG-Report–2539(S)) IRRADIATION DAMAGE. UKAEA Diffraction Analysis Conference, 21st Meeting, Bournemouth, 14-15 November 1973. Ferguson, I. F. (ed.). (UKAEA Reactor Group, Risley). Oct 1974. 89p. (CONF-731157–). UK £ 2.00.

The status of current studies in the UKAEA on irradiation damage using diffraction methods is surveyed. Instrumental developments in diffraction methods within the UKAEA are also described. These include the scanning electron microscope with Auger analysis attachment, low-angle x-ray scattering, and energy dispersive x-ray analysis. Notes are also included of a discussion of the JCPDS x-ray data search programme. Of the seventeen papers, eight are reported in abstract form only. (UK)

17010 PHASE DIAGRAM OF THE Zr–Nb–Sn–O QUATERNARY SYSTEM AND OF ADJACENT TERNARY SYSTEMS. Tararaeva, E. M.; Murav'eva, L. S.; Ivanov, O. S. pp 138-143 of Stroenie i Svoistva Splavov Dlya Atomnoi Energetiki. Razdel I. Moscow; Atomizdat (1973). (In Russian).

By microscopic and x ray analysis methods, by measuring the hardness and microhardness, and also by x-ray microanalysis for Sn and Nb, a study was carried out of the Zr corner of the Zr–Nb–Sn–O system and adjacent ternary systems. As a result of the study, isothermal cross sections of the phase diagram were constructed for Zr–Nb–Sn, Zr–Nb–O, Zr–Sn–O, and Zr–Nb–Sn–O at 100, 900, 700 (800), and 600°C. (SJR)

17011 DISPERSION COMPOSITES WITH SKELETON STRUCTURE IN NUCLEAR ENGINEERING. Cech, B.; Splichal, K. Kovove Mater.; 12: No. 2, 280-293(1974). (In German).

Dispersion composites with one or both phases having skeleton structure are reviewed, with emphasis on use in nuclear engineering. The difference between skeleton structure and a dispersion of isolated particles in a matrix is pointed out. Structure stability is discussed. Composites of light and nonfissionable metals such as Al, Mg, Be, Zr, and those of U are dealt with, and microstructures are shown. (19 references) (Metals Abstr.)

17012 SIXTH NATIONAL SAMPE TECHNICAL CONFERENCE. Volume 6. Materials on the Move. Conference Held at Dayton, Ohio, October 8–10, 1974. National SAMPE Technical Conference Series. Azusa, CA; Society for Advancement of Material and Process Engineering (1974). 473p. (CONF-741058–). $40.75.

This conference was focused on materials and their applications in transportation on air, ground, and sea. Nondestructive testing, automobile emission control, lubricants, and hydraulic fluids are covered. Separate abstracts were prepared for 4 of the 52 papers. (DLC)

For abstracts of individual papers see: 16491, 17118, 17177, and 17462.

17013 SOME QUESTIONS OF THE THEORY OF DIFFUSION IN MULTICOMPONENT SYSTEMS. Krishtal, M. A.; Mokrov, A. P. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 9-17 (1973).

Diffusion equations are developed on the basis of the thermodynamics of steady-state irreversible processes. Applications of the theory are given for ternary systems containing elements that form interstitial solutions and those forming substitutional solutions, and under both isothermal conditions and conditions under which a temperature gradient exists. Illustrative examples include Fe–Si–C, Fe–Cr–C, Fe–W–C and a two-component system, Sb in Ag. (Metals Abstr)

17014 ELECTRON ENERGY LOSSES IN A LIGHT FIELD. Strekalov, V. N. (Moscow Physical-Technical Inst.). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 3, 483-485(Sep 1974).

Translated from Fiz. Tverd. Tela; 16: No. 3, 741-744(Mar 1974).

The efficiency of the two mechanisms of electron energy loss in creating optical phonons, with the participation of a photon and without it, is compared. Although the probability of an elementary event of the first process is less than that of the second, a larger number of electrons participate in it, as a result of which the overall rate of energy loss in the first process is increased. This increase is particularly important at particle frequencies close to the frequency of the optical phonon: Almost all free electrons can participate in the creation of phonons. Under these conditions a relationship might be expected between the shape of the absorption line and the free electron density. In those cases when the first mechanism leads to losses of the same order or greater than the losses due to the second mechanism, spatial and time modulation of the electron energy losses becomes possible. A knowledge of the electron energy loss is the basis for estimation of the electric field strength of the light wave which fractures the crystal. (auth)

Ceramics and Cermets

Refer also to abstracts 16108, 17108, 17110, 17111, 17115, 17127, 17135, 17211, 17227, 17300, 17340, 17386, 17422, 17432, 17433, 17443, 18750, 18768, 18769, 18781, and 19025.

17015 (ANL-AFP-2) EQUATION-OF-STATE FOR ADVANCED FUELS. Sheth, A.; Leibowitz, L. (Argonne National Lab., Ill. (USA)). Oct 1974. Contract W-31-109-eng-38. 21p. Dep. NTIS $4.25.

A preliminary examination has been made of physical property data for uranium and plutonium carbides and nitrides. A set of recommended values has been prepared for the compounds UC, UN, PuC, PuN, (U,Pu)C, and (U,Pu)N. The properties that have been evaluated are heat capacity, enthalpy, vapor pressure, melting point, heat of vaporization, and heat of fusion. This evaluation is a prelude to a more extensive critical study of existing property data for candidate advanced fuels. The data presented should be considered an interim set until the rigorous critique, now in progress, is completed. (auth)

17016 (BARC-718) DAMAGE DIFFUSION OF XENON IN SINTERED THORIA POWDERS. Naik, M. C.; Paul, A. R.; Kaimal, K. N. G.; Karkhanavala, M. D. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 19p. Dep. NTIS (US Sales Only) $4.00.

The attachment behavior of xenon following (η,γ) events on sintered thoria powders of particle size 105 to 125, 63 to 75, 37 to 45, and less than 10 μ has been studied at different xenon gas pressure. The attachment efficiency of ^{125}Xe is maximum compared with other isotopes of xenon. It has been observed that for powders of particle size less than 10 μ the attachment efficiency is independent of gas pressure, but for larger particles it decreases at higher pressures (> 300 torr). The burst release kinetics of attached ^{125}Xe from the damaged superficial layer of thoria powders has been studied as a function of temperature. Results have been interpreted on a model involving single jump of gas atoms and a spectrum of activation energy. (auth)

17017 (BMI-1605) DEVELOPMENT OF ADVANCED HIGH-TEMPERATURE NUCLEAR MATERIALS DURING AUGUST–

OCTOBER 1962. Dickerson, R. F.; Chubb, W. (Battelle Columbus Labs., Ohio (USA)). 1 Dec 1962. Contract W-7405-eng-92. 47p. Dep. NTIS $5.50.

Declassified 4 Sep 1973.

A study of the irradiation and chemical stability of nuclear fuel-cladding systems at very high temperatures is in progress. The results of an irradiation of UC$_{1.45}$ clad in niobium-1 wt % zirconium alloy at maximum surface temperatures above 2200°F and at burnups ranging from 1.7 to 2.0 at. % of the uranium are reported. Additional compatibility data confirm previous findings that, of the metals molybdenum, niobium, tantalum, and tungsten, tungsten has the lowest rate of reaction with uranium carbides at temperatures up to at least 2800°F. The uranium-carbon-tungsten ternary system was found to possess a pseudobinary equilibrium tie line between metallic tungsten and uranium monocarbide at temperatures above 2730°F. New data on the free energies of formation of the three uranium carbides are presented. The data are in good agreement with the currently accepted constitutional diagram. (auth)

17018 (BMI-1617) DEVELOPMENT OF HIGH-TEMPERATURE HYDROGEN-IMPERMEABLE CERAMIC COATINGS FOR HASTELLOY N. King, B. W.; Bowers, D. J.; Hedden, W. A.; Lennon, J. W.; Duckworth, W. H. (Battelle Columbus Labs., Ohio (USA)). 20 Feb 1963. Contract W-7405-eng-92. 31p. Dep. NTIS $4.75.

Declassified 5 Sep 1973.

Progress was made in research to develop a thin ceramic coating for Hastelloy N tubes to prevent excessive loss of hydrogen by permeation through the tube walls. Compositional studies of low-cross-section glass-forming systems stable in hydrogen along with the development of application methods to provide defect-free coatings provided 1-mil-thick special coatings that were not affected adversely by an exposure of 500 h in hydrogen at 1700°F. Permeability tests are in progress at Atomics International. (auth)

17019 (BMI-1730) HIGH-TEMPERATURE IRRADIATION OF NIOBIUM−1 WT % ZIRCONIUM-CLAD UO$_2$. Kangilaski, M.; Fromm, E. O.; Lozier, D. H.; Storhok, V. W.; Gates, J. E. (Battelle Columbus Labs., Ohio (USA)). 28 Jun 1965. 65p. Dep. NTIS $6.25.

Declassified 31 Aug 1973.

Twenty-four 0.225-in.-dia and six 0.290-in.-dia UO$_2$ specimens clad with 80 mils of Nb−1 wt % Zr were irradiated to burnups of 1.4 to 6.0 at. % of uranium at surface temperatures of 900 to 1400°C. UO$_2$ and lithium were found to be incompatible at these temperatures and the thick cladding was used primarily to minimize the chances of contact of UO$_2$ and the lithium coolant. The thickly clad specimens did not undergo any dimensional changes as a result of irradiation, although it was found that movement of UO$_2$ took place in the axial direction by a vaporization−redeposition mechanism. It was found that 32 to 87% of the fission gases was released from the fuel, depending on the temperature of the specimen. Metallographic examination of longitudinal and transverse sections of the specimens indicated the usual UO$_2$ microstructure with columnar grains. Grain-boundary thickening was observed in the UO$_2$ at higher burnups. The oxygen/uranium ratio of UO$_2$ increased with increasing burnup. (30 fig, 11 tables) (auth)

17020 (BMI-1804) DEVELOPMENT OF ADVANCED HIGH-TEMPERATURE NUCLEAR MATERIALS DURING FEBRUARY−APRIL 1967. Keller, D. L.; Chubb, W. (Battelle Columbus Labs., Ohio (USA)). 1 May 1967. Contract W-7405-eng-92. 129p. Dep. NTIS $9.50.

Declassified 4 Sep 1973.

Microstructures of UC-tungsten cermets irradiated at temperatures near 1750°C show fission-gas bubbles ranging in size from less than 1μ to as large as 20μ in diameter within UC particles about 60μ in diameter. These bubbles apparently cause swelling prior to release of the gas from the cermet. Although 75 percent of the gas apparently was released from the cermets, they swelled at a rate of 20 vol % per 10^{20} fissions per cm^3. Swelling rates appeared to be a linear function of burnup in one experiment and an increasing function of burnup in another experiment. Molybdenum and molybdenum-alloy (TZM) capsules have contained lithium without signs of leakage or corrosion for 1000 h at a maximum temperature of 1600°C with a temperature gradient of 150 to 200°C. Indications were obtained that the acicular phase observed as a precipitate in UC-TaC alloys contains less than 50 at. % carbon and a higher percentage of tantalum than the alloy from which it precipitated. The precipitate was not observed in hyperstoichiometric alloys of UC−TaC nor UC−NbC. Techniques were developed for fabricating UN-tungsten cermets with a major fraction of the porosity associated with the UN particles. Under equilibrium conditions, the vapors over UN contain much more nitrogen than uranium so that if this vapor is removed under quasi-equilibrium conditions, the UN will decompose very slowly into liquid uranium and this vapor. However, if evaporation rates are increased to those normally observed when UN is freely exposed to a dynamic vacuum and if the temperature is kept below 1800°C, then a kinetic barrier probably related to the formation of the nitrogen molecule on the surface of the UN inhibits the evaporation of molecular nitrogen; as a result, the vapor over the UN tends to contain almost twice as many moles of uranium as of nitrogen so that negligible quantities of liquid uranium will form in the solid UN. Attempts to measure the solubility and diffusion of fission gas in UC showed "diffusion rates" greater than the self-diffusion rate of uranium in UC at 1600 to 1800°C and at a concentration of 3.8×10^{14} fissions per cm^3 (about one atom of fission gas per billion of uranium and carbon). It is suggested that the burst phenomenon is related to the diffusion of fission-gas atoms in solution in UC. (auth)

17021 (BMI-1806) IRRADIATION BEHAVIOR OF URANIUM MONOCARBIDE. Task No. 6. Melehan, J. B.; Markworth, A. J.; Perrin, J. S.; Wullaert, R. A.; Chubb, W.; Gates, J. E. (Battelle Columbus Labs., Ohio (USA)). 26 Jun 1967. Contract W-7405-eng-92. 40p. Dep. NTIS $5.00.

Declassified 4 Sep 1973.

The irradiation behavior of hyperstoichiometric UC was studied at surface temperatures up to 1350°C and at burnups up to approximately 3.6 at. % of the uranium (10×10^{20} fissions per cm^3). Fully dense uranium carbide increased 0.5 to 1.0% in volume per 10^{20} fissions per cm^3 at surface temperatures up to about 1100°C. The critical temperature where swelling of UC increased rapidly with increasing temperature is apparently near 1100°C. Swelling appeared to be reduced only slightly by a thicker cladding. UC swelled as much in 0.5-mm-thick W−26% Re claddings as in 0.5-mm-thick Nb−1% Zr claddings. UC specimens with densities as low as 87% theoretical exhibited density changes comparable to those of fully dense material, but increases in fission-gas release with decreasing postirradiation bulk densities were exhibited. Fission-gas release from initially fully dense material was less than 2% from 900 to 1250°C; however, higher rates of gas release are anticipated as a function of decreasing density at higher burnups and higher temperatures. (27 figures) (auth)

17022 (BNL-19348) ABSORPTION AND LUMINESCENCE OF GLASSES DURING ELECTRON IRRADIATION. Swyler, K. J.; Hardy, W. H. II; Levy, P. W. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 10p. (CONF-750102-2). Dep. NTIS $4.00.

From topical meeting on optical fiber transmission; Williamsburg, Virginia, USA (7 Jan 1975).

Absorption spectrum, growth and decay curves, and luminescence emission measurements have been made on NBS 710 and 711, and AO-"C" glass during and after 1.5 MeV electron irradiation. (auth)

17023 (BNWL−309) DEVELOPMENT OF TUNGSTEN−URANIUM DIOXIDE CERMET FUEL PLATES: FABRICATION BY ROLLING OR BY PNEUMATIC IMPACTION. Final Report. Nelson, R. G.; Quinlan, F. B.; Brite, D. W.; Sump, K. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1966. Contract AT(45-1)-1830. 72p. (NASA-CR−54850). Dep. NTIS $6.75.

Declassified 28 Aug 1973.

One process studied was a power metallurgy−hot roll cladding process previously developed. The size of the plates represented about a threefold increase over that which had been produced. This work describes the developments required to scale-up the process. Process development work which eliminated a costly grinding step is described. Special tooling for shearing and flattening is described along with basic changes in materials and design of sintering furnaces and a roll cladding furnace. 244 plates that were within the required specifications were delivered. A powder metallurgy−pneumatic impaction process also was evaluated. The plates were fabricated from mixtures of W and UO$_2$ powders and from W coated UO$_2$ spheres. The process was shown to be flexible as to cermet composition, extent and type of cladding, and specimen size and configuration. Several crack-free plates with densities greater than 98% of theoretical were produced. (23 fig, 6 tables) (auth)

17024 (CONF-741202-14) MAGNETIC MOMENT DISTRIBUTION IN URANIUM DIOXIDE. Faber, J. Jr. (Argonne National Lab., Ill. (USA)). Oct 1974. 9p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The magnetic form factor of uranium in UO$_2$ has been examined by means of neutron diffraction. Uranium dioxide (CaF$_2$ structure) orders antiferromagnetically at 30.8°K with the type I magnetic structure. The intensities of 1250 magnetic Bragg reflections (reducing to 71 independent hkl values and giving full three-dimensional data for $\sin \theta/\lambda \leq 0.83$ Å^{-1}) have been measured with a well-characterized stoichiometric single crystal at 5°K. The values of (uf) plotted versus $\sin \theta/\lambda$ show considerable asphericity for $\sin \theta/\lambda > 0.5$ Å^{-1}. Comparisons with free-ion (+ crystal field) calculations give an experimental magnetic moment of 1.78 (4) μ_B and indicate that the general shape of the form factor is in agreement with theory for low scattering angles, but that the nonspherical contributions at higher angles are at least a factor of five greater than expected. The significance of these results is discussed in terms of the extended nature of the 5f wavefunctions in UO_2. (auth)

17025 (GERHTR-116) CONTRIBUTION TO THE U_2C_3 FORMATION BY THE SYNTHETIC REACTION AND BY THE DECOMPOSITION OF UC_2. Buschinelli, A. J. A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jun 1974. 146p. (In German). (JUL-1081-RW). Dep. NTIS (US Sales Only) $10.50.

Thesis. Submitted to Technische Hochschule, Aachen, West Germany. Work performed under United States–German High Temperature Reactor Research Exchange Program.

The mechanism and kinetics of U_2C_3 formation by the synthetic reaction were studied. The influence of mechanical and thermal pre-treatment of the samples on the reaction kinetics were investigated and discussed taking into account other information from the literature. The relative increase of U_2C_3 nucleation rate due to pulverization corresponds approximately to the surface enlargement of the pulverized material. The activation energy for the synthetic reaction in powder was found to be 94 ± 7 kcal/mol. The negative influence of nitrogen, oxygen, and tungsten on U_2C_3 formation is reported. In the decomposition of UC_2 to U_2C_3 and graphite, the influence of morphology of the graphite precipitate and fast neutron irradiation on the beginning of the U_2C_3 formation were also investigated. (auth)

17026 (IAEA-R-696-F) INVESTIGATION OF FERROELECTRIC AND FERROMAGNETIC CRYSTALS SUBJECTED TO IONIZING RADIATION. Final Report for the Period 1 January 1969–30 April 1971. Belov, V. F. (International Atomic Energy Agency, Vienna (Austria)). Dec 1972. vp. (In Russian). INIS.

Various ferrites of the type $Y Fe_{1-x}Al_xO_3$, $Mn_{1-x}Zn_xFe_2O_4$, and triglycine sulfate were investigated with EPR, NMR, Moessbauer spectroscopy, and x-ray scattering. In triglycine sulfate crystals subjected to gamma-ray radiation, the changes in the domain structure were studied. In crystals with randomly oriented domains, irradiation gives rise to formation of new domains and deformation of domain walls. In unipolar crystals which exhibit preferential domain orientation no strong alternations in domain structure following irradiation were observed. In ferrites $Y Fe_{1-x}Al_xO_3$, the influence of Al^{3+} ions on magnetization, chemical shift, and quadrupole splitting was studied using Moessbauer spectroscopy. The observed reduction of magnetization with the introduction of aluminum ions was ascribed to a disparate reduction of the exchange field for Fe^{3+} ions having a different number of Al^{3+} ions in their immediate co-ordination sphere. The magnetic properties of $Mn_{1-x}Zn_xFe_2O_4$ as a function of x were investigated. (INIS)

17027 (IBK-1147) NONDESTRUCTIVE BURNUP DETERMINATION OF THE NUCLEAR FUEL BY SINGLE ROD METHOD. Zdravkovicj, Z. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). Oct 1973. 82p. (In Serbian). INIS.

Thesis.

17028 (KFK-2030) KAPITZA RESISTANCE AT BOUNDARIES BETWEEN SOLIDS. Schmidt, C. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Experimentelle Kernphysik). Aug 1974. 112p. (In German). Dep. NTIS (US Sales Only) $8.75.

Thesis. Submitted to Karlsruhe Univ. (TH) (West Germany). Fakultaet fuer Physik.

The thermal boundary layer resistance (Kapitza resistance) R_k was measured at a number of metal-to-insulator and metal-to-metal boundary layers. Reproducible results could be obtained for sapphire–indium boundary layers and it is shown that the deviation between the results measured by others can be explained by the way of sample preparation. A reduction of R_k after transition of indium into the normal state was observed without doubt. In the heat transfer between metals R_k plays a part if one of the metals is superconducting and thus the conduction electrons are not available for heat transport. Nb–Cu and NbTi–Cu boundary layers were investigated. Thermal conductivity measurements were performed with epoxy resins filled with copper powder as a function of the filler concentration and the grain size; they were supplemented by the direct measurement of R_k between epoxy resin and copper. In all cases, the experimental values obtained for R_k were above the prediction according to the Acoustic Mismatch Theory. (auth)

17029 (KFK-EXT-6/74-5) STRUCTURE, PREPARATION, AND PROPERTIES OF REFRACTORY COMPOUNDS AND SYSTEMS. Semiannual Report, January–June 1974. Holleck, H.; Thuemmler, F. (eds.). (Kernforschungszentrum Karlsruhe (F.R. Germany)). Aug 1974. 81p. (In German). Dep. NTIS (US Sales Only) $7.25.

Results on the hardness properties of mixed carbides and carbonitrides of the transition metals are summarized. Hot hardness measurements of $(Ta,Mo)C_{1-x}$ and $(Ta,W)C_{1-x}$ as well as the influence of composition and heat treatment on the hardness of Ta-carbonitrides are described. Also included are the results of x-ray investigations of the dissociation of Ta-carbonitrides. The type of hardness indentations in refractory carbides and the tendency for crack formation as well as the load sensitivity of the microhardness, led to special investigations on this topic. Preliminary results are reported. The wetting and chemical interactions between the carbides and binder metals are the topic of a number of contributions. The eutectica in such quasibinary equilibrium diagrams are also given. The sintering behavior and properties of cemented Ta– and Ta–Hf carbonitrides are also described. (auth)

17030 (LAMS-2587) FABRICATION OF URANIUM-LOADED GRAPHITE. Schell, D. H.; Taub, J. M.; Taylor, J. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 10 Jul 1961. 58p. Dep. NTIS $6.00.

Declassified 29 Aug 1973.

Materials, equipment, and procedures used in the development of a fabrication process to produce fuel elements for a Kiwi reactor core are described. A basic composition of 77.5% graphite flour, 15% carbon black, and 7.5% flake graphite formed the extrusion mix which was bonded with a catalyzed thermosetting resin. The uranium loading was added in the form of enriched UO_2 powder. Successive mixing and blending steps prepared the mix for extrusion into nominally 1-in. OD tubes. The extruded tubes were processed through a series of heat treatments to cure the resin binders, remove volatile hydrocarbons, convert the UO_2 to carbide, and graphitize the carbon materials. During processing, various defects occurred in the form of spalling, blistering, inclusions, cracking, voids, and reversal of the oxide carbide reaction. The steps taken to eliminate these problems are discussed. The development achieved a process which was used to fabricate fuel elements meeting the rather severe specifications of the reactor core. (21 figures) (auth)

17031 (LA-UR-74-1625) MAGNETISM IN NEPTUNIUM BORIDES. Smith, J. L.; Hill, H. H. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 8p. (CONF-741202-7). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Magnetization measurements were performed on NpB_2, NpB_4, and NpB_{12} over the temperature range 2 to 180°K. NpB_2 is ferromagnetic below $T_C = 99.5 \pm 2$°K; NpB_4 antiferromagnetic below $T_N = 52.5 \pm 2$°K. These compounds exhibit approximate Curie-Weiss behavior above their ordering temperatures. The corresponding Pu compounds as well as PuB_6 were found not to exhibit magnetic ordering above 2°K. The susceptibility of NpB_{12} is relatively independent of temperature. Attempts to prepare NpB_6 in the arc furnace were unsuccessful. The ferromagnetism of NpB_2 is apparently itinerant in nature, the moment being unsaturable at 52 kOe and 2°K and having magnitude ~0.3 μ_B per Np atom. The very occurrence of magnetism in the compound is somewhat surprising considering the relatively small separation between nearest-neighbor Np atoms in the compound, $d_{Np-Np} = 3.16$ Å. (auth)

17032 (ORNL-TM-1395) DISPERSION OF A LIQUID STREAM BY AN ELECTRICAL POTENTIAL: APPLICATIONS TO THE PREPARATION OF THORIA MICROSPHERES. Helton, D. M. (Oak Ridge National Lab., Tenn. (USA)). 17 Jan 1966. Contract W-7405-eng-26. 17p. Dep. NTIS $4.00.

A method was developed for the dispersion of a liquid stream into drops of controlled diameter in an immiscible second liquid. The method involves the application of an electrical potential to the dispersing nozzles. The drop diameter is a function of the charging potential and the flow rate of the liquid to be dispersed. In these studies, the drop size was controlled over the range 50 to 350 microns. In this work, only dc potentials were employed; however, it was found that 60 cycle ac potential also worked. Single and multiple nozzles were used to disperse 2 to 3 M thoria sols at flows of 0.2 to 21 cc/min into 2-ethyl-1-hexanol for preparation of thoria microspheres. (auth)

17033 (ORNL-TM-4780) COMPATIBILITY OF Eu_2O_3 WITH TYPE 316 STAINLESS STEEL AND SODIUM. DiStefano, J. R. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 32p. AT.

Europium oxide is an excellent candidate for a neutron absorber in liquid-metal-cooled breeder reactors. It has a high nuclear worth that it retains during burnup, and it can readily be fabricated into dense pellets. Compatibility tests showed that type 316 stainless steel can be used as a cladding for Eu_2O_3 at temperatures up to 870°C. No evidence of attack was observed with sintered monoclinic Eu_2O_3, but up to 25 μm grain-boundary attack was found when type 316 stainless steel was exposed to hot-pressed monoclinic Eu_2O_3 at 870°C. Tests with sodium at 650 and 760°C showed that Eu_2O_3 is penetrated by sodium, but there was no attack of the stainless steel. Diametral increases of up to 1% occurred in sintered monoclinic Eu_2O_3 after 1000 h exposure to sodium. (auth)

17034 (RN-S-0458) BEARING RETAINER MATERIALS DEVELOPMENT. Second Progress Report. Dessau, P. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1968. 97p. Dep. NTIS $8.00.

During the period of July–December 1967, four additional wear tests were run. In accordance with the findings of earlier tests, a new, single-piece tester shaft was used and screening was accelerated by testing materials candidates singly, rather than in duplicate. In addition, tester speed was increased to simulate wear performance of a larger retainer. A corollary to the wear test program was the fabrication and testing of 50-mm ball retainers incorporating materials with promising wear and mechanical properties. Six tests were performed during this period. (auth)

17035 (UCID-15306(Pt.1)) CONTRIBUTION TO THE 26th MEETING OF THE HIGH-TEMPERATURE FUELS COMMITTEE, APRIL 30–MAY 2, 1968, WINDSOR, CONNECTICUT. Rothman, A. J. (comp.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Apr 1968. 27p. (CONF-680478-). Dep. NTIS $4.50.

From 26th meeting of the high-temperature fuels committee; Windsor, Connecticut, USA (30 Apr 1968).

Data and information are presented on UN synthesis and fabrication, UN phase equilibria, N diffusion in UN, crystal growth in UN, elastic properties of UN, superconductivity in UN, determination of O and C in Li, and solubility of W in Ag. (auth)

17036 (WANL-TME-1821) FINAL TEST SPECIFICATION Cu-B^{10} MATERIALS TEST 37/W409. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1968. 10p. Dep. NTIS $4.00.

Specifications for radiation effects testing of $Cu^{10}B$ materials at –320 to 1080°F are outlined. Procedures are included for specimen receiving inspection, pre-irradiation measurements, reactor operations, and post-irradiation measurements and inspections. (JRD)

17037 (WANL-TME-1821(Rev.1)) FINAL TEST SPECIFICATION: Cu–^{10}B MATERIALS TEST, 37/W409. Revision One. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1968. 21p. Dep. NTIS $4.25.

Revised specifications for radiation effects testing of $Cu^{10}B$ materials at –320 to 1080°F are outlined. Procedures are included for specimen receiving inspection, pre-irradiation measurements, reactor operations, and post-irradiation measurements and inspections. (JRD)

17038 (WANL-TMI-2007) NERVA LONG LIFE CORE PERIPHERY CANDIDATE MATERIALS. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1970. 80p. Dep. NTIS $7.00.

A screening study and literature search was conducted to assist in the selection of corrosion resistant materials for filler strip and insulation applications for a long-life core periphery in the NERVA environment. An analysis of the nuclear properties for determining the refractory compounds with neutron absorption cross sections lower than that of niobium carbide was conducted. A survey of the literature was made for the melting points, densities, specific heat, thermal conductivity, thermal expansion, compressive, tensile and flexural strength, Young's modulus, hardness, hydrogen corrosion resistance, chemical stability, and thermal shock resistance of the nuclear candidate compounds. Data sheets are presented. A thermodynamic analysis of the stability in hydrogen of the most likely candidate materials was conducted. It was concluded that zirconium carbide and stabilized zirconium oxide are prime corrosion resistant material candidates, respectively, for the filler strip and thermal insulation applications. Backup candidate materials are niobium carbide for filler strips and possibly yttrium oxide for the insulation applications. Thin coatings of thoria applied to zirconium carbide is also a backup insulating candidate. Recommendations are made for materials development programs, further literature searches, material analyses, and property characterizations. (auth)

17039 (WANL-TNR-185) DIFFUSION IN THE NIOBIUM–CARBON SYSTEM. Brizes, W. F.; Cadoff, L. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1964. 22p. Dep. NTIS $4.25.

Equations for the computation of the diffusivities of carbon in the NbC and Nb_2C phases are given. The diffusion coefficients for each phase were determined over the temperature range 1600 to 2200°C where the diffusivities were assumed independent of concentration. The general equations fitting the experimental data follow: $D^{C}_{NbC} = 1 \times e^{-78\ kcal/RT}$, $D^{C}_{Nb_2C} = 9 \times 10^{-2} e^{-55\ kcal/RT}$. By observing marker movements in a couple annealed at 2100°C, it was found that the niobium flux in the NbC phase could be considered negligible and the growth of the carbide phases are due predominantly to carbon diffusion. Markers placed in the graphite phase indicated that the carbon atoms were simply consumed from the surface of the graphite phase and diffused into the niobium sample. (auth)

17040 SUPERCONDUCTING TRANSITION TEMPERATURES AND ANNEALING EFFECT OF SINGLE-CRYSTALLINE NbN_x FILMS. Oya, G.; Onodera, Y.; Muto, Y. (Tohoku Univ., Sendai). pp 399-402 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Relations between transition temperatures and the crystal structure of monocrystalline NbNx films are described. It was found experimentally that the maximum transition temperature in NbN is associated with the NaCl–type structure. (JRD)

17041 HIGH-TRANSITION-TEMPERATURE TERNARY SUPERCONDUCTORS. Matthias, B. T. (Bell Telephone Labs., Murray Hill, NJ). pp 416 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Methods of increasing the temperature range in which superconductivity occurs are discussed. It is noted that ternary compounds represented by formulas such as Ti_3S_4 and Mo_3S_4 stabilized by a third element have superconducting transition temperatures as high as 17°K. (JRD)

17042 LAYERED COMPOUNDS, INTERCALATION, AND MAGNETIC SUSCEPTIBILITY MEASUREMENTS. Di Salvo, F. J. (Bell Telephone Labs., Murray Hill, NJ). pp 417-427 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A review is presented of the structure and properties of layered compounds such as dichalcogenides, and compounds formed by intercalation having layered structure incorporating a skeleton structure that forms van der Waals bonded slabs if the intercalate is missing. Results of magnetic susceptibility measurements on compounds intercalated with organic molecules are also presented. (JRD)

17043 FLUCTUATION EFFECTS ON THE MAGNETIC PROPERTIES OF SUPERCONDUCTING LAYERED COMPOUNDS. Prober, D. E. (Harvard Univ., Cambridge, MA); Beasley, M. R.; Schwall, R. E. pp 428-432 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results are presented of a preliminary investigation of the low-field magnetic behavior of the intercalated superconductor TaS_2 $(pyridine)_{1/2}$. Emphasis is placed on the enhanced diamagnetism due to thermally induced superconducting fluctuations above the superconducting transition. Evidence was found of two-dimensional superconducting fluctuations above the superconducting transition in this compound. (JRD)

17044 STUDIES OF THE PROPERTIES OF THE SYSTEM $TaS_{2-x}Se_x$. Revelli, J. F. Jr.; Phillips, W. A.; Schwall, R. E. (Stanford Univ., CA). pp 433-437 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of electric conductivity and superconductivity transition temperature are presented along with color observations showing that $TaS_{2-x}Se_x$ physical properties are principally determined by the coordination of the Ta atoms. Phases in this compound exhibiting pure trigonal prismatic character have higher transition temperature and are electrically metallic, while those phases having half-octahedral and half-trigonal prismatic character show lower transition temperature and less metallic character. (JRD)

17045 NUCLEAR MAGNETIC RESONANCE IN LAYERED DISELENIDES. Silbernagel, B. G. (Univ. of California, Santa Barbara); Gamble, F. R. pp 438-441 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies are presented on the Knight shifts of the ^{77}Se nucleus in diselenides containing transition metals of Periodic groups IV B, V B, and VI B. Data on Knight shift in these compounds are tabulated and analyzed. (JRD)

17046 ELECTRON LOCALIZATION IN GRANULAR METALS. Abeles, B.; Sheng, P. (RCA Labs., Princeton, N. J.). pp 578-583 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Electron tunneling in granular metals was used to observe the development of an energy gap in the tunneling density of states associated with the metal-nonmetal transition in these materials. Tunneling structures consisting of Ni or Al as the superconducting film and SiO_2 the dielectric film were co-sputtered. It was found that bulk superconductivity vanishes in granular superconductors when the normal conductivity is less than about 100 ohm^{-1} cm^{-1}. (JRD)

17047 NEUTRON SCATTERING, PHONON SPECTRA, AND SUPERCONDUCTIVITY. Smith, H. G. (Oak Ridge National Lab., TN); Wakabayashi, N.; Nicklow, R. M.; Mihailovich, S. pp 615-618 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Investigations of anomalies in longitudinal acoustic branches in ZrC and NbC are reported in studies of electron−phonon interactions. It is noted that a satisfactory lattice dynamics theory does not exist for explaining these anomalies. (JRD)

17048 SUPERCONDUCTIVITY AND ANOMALOUS PHONON DISPERSION IN TaC. Allen, P. B. (State Univ. of New York, Stoney Brook); Cohen, M. L. pp 619-622 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A new theoretical basis is given for a quantitative connection between the softening of phonon spectra in HfC and TaC and an increase in transition temperature. (JRD)

17049 ELEVATED TEMPERATURE DEFORMATION OF THORIA DISPERSED NICKEL−CHROMIUM. Kane, R. D. Cleveland; Case Western Reserve Univ. (1974). 105p. University Microfilms Order No. 74-27,527.

Thesis (Ph. D.).

The deformation behavior of thoria dispersed nickel−chromium (TD−NiCr) was examined over the temperature range 593°C to 1260°C in tension and compression and at 1093°C in creep. Major emphasis was placed on 1) the effects of the material and test related variables (grain size, temperature, stress and strain rate) on the deformation process, and 2) the evaluation of single crystal TD−NiCr material produced by a directional recrystallization process. Elevated temperature yield strength levels and creep activation enthalpies were found to increase with increasing grain size reaching maximum values for the single crystal TD−NiCr. Stress exponent of the steady state creep rate was also significantly higher for the single crystal TD−NiCr as compared with that determined for the polycrystalline materials. The elevated temperature deformation of TD−NiCr was analyzed in terms of two concurrent−parallel processes: diffusion controlled grain boundary sliding, and dislocation motion. The characteristics of the dislocation motion deformation mode (as observed in the single crystal) suggest that dislocation motion is strongly affected by dislocation-particle interactions arising from surface tension stresses around thoria particles. The relative contribution of dislocation motion and grain boundary sliding in TD−NiCr was estimated. In creep, grain boundary sliding was found to predominate for the small, equiaxed grain structures, whereas the dislocation deformation mode became significant only for the large grain TD−NiCr (at relatively high creep stresses) and the single crystal material. (Diss. Abstr. Int., B)

17050 STUDIES OF HYDROLYZABLE CARBIDES. VI. Neodymium Dicarbide: Its Preparation and Hydrolysis. Brozek, V. (Vysoka Skola Chemicko-Techologicka, Prague); Hajek, B.; Mostecky, J. (Vysoka Skola Chemicko-Technologicka, Prague). Sb. Vys. Sk. Chem.-Technol. Praze, Anorg.; 14: 27-44(1972). (In Czech).

Exhalograph EA-1 Balzers was applied to observe the reduction of neodymium trioxide by carbon under reduced pressure with the object of preparing a defined neodymium dicarbide. The carbidic product formed was hydrolyzed, the gaseous decay products were investigated applying mass, infrared, and ultraviolet spectrometry and gas chromatography. It was found that the gaseous products were formed by a mixture of hydrogen and linear hydrocarbons of the C_2, C_4, C_6, C_8, and C_{10} series whose proportion changes as a result of continuing cold hydrogenation and polymerization, catalyzed by the solid phase formed during the decomposition of neodymium dicarbide. The ratio of hydrogen and carbon in gaseous products has, however, a constant value of approximately 1.5. (INIS)

17051 IDENTIFICATION OF SCANDIUM MONOXIDE. Dufek, V. (Vysoka Skola Chemicko-Technologicka, Prague). Sb. Vys. Sk. Chem.-Technol. Praze, Anorg.; 14: 183-194(1972). (In German).

The reduction of Sc_2O_3 at 1750°C under hydrogen atmosphere containing a certain amount of carbon monoxide yielded a blueish grey powder. By thermogravimetric and chemical analyses the composition of the powder was proved to correspond to the formula ScO. It was air- and water-resistant under normal conditions. Its crystal structure was identical to the "cubic scandium modification" of Meisel. Through hotpressing of the powder at 1800°C a compact substance with considerable hardness, a density of 4.33 g/cm^3, and a strong paramagnetism was prepared. Infrared absorption spectra supported the assumption of an ionic character of this substance. Various analyses proved that no diffusion took place with the nitride, hydride, carbide, or the "cubic modification" of scandium. (INIS)

17052 CONTRIBUTIONS TO THE CHEMISTRY OF RARE ELEMENTS. LXV. Formation of Mixed Crystals in the System of $Sm_2O_3-Y_2O_3$, $Sm_2O_3-Yb_2O_3$, and $Sm_2O_3-Dy_2O_3$. Hajek, B.; Kalalova, E.; Stompfova, H. (Vysoka Skola Chemicko-Technologicka, Prague). Sb. Vys. Sk. Chem.-Technol. Praze, Anorg.; 14: 21-26(1972). (In Czech).

Mixed crystals in the systems $Sm_2O_3-Y_2O_3$, $Sm_2O_3-Dy_2O_3$, and $Sm_2O_3-Yb_2O_3$ were prepared and studied applying the Debye-Scherrer x-ray diffraction method. The presence of Y^{3+}, Dy^{3+} and Yb^{3+} stabilizes the cubic lattice of $Sm_2O_3 \cdot Sm_2O_3$ and Y_2O_3 form a series of mixed crystals with continuously varying concentration, while Sm_2O_3 and Dy_2O_3 form mixed crystals only in the range of 0 to 60 mole % of Sm_2O_3. The formation of mixed crystals of Sm_2O_3 with Yb_2O_3 was studied only in the range of 0 to 75 mole % of Sm_2O_3; in this range a continuous series of mixed crystals was ascertained. (INIS)

17053 BARRIER-LAYER CAPACITANCE OF DIFFUSED-SILICON P−N JUNCTIONS IRRADIATED WITH FAST NEUTRONS. Emel'ianova; T. S.; Kozhukhova, E. A.; Shakhovtsov, V. I. (Inst. of Physics, Kiev). Poluprov. Tekh. Mikroelektron.; No. 14, 55-64(1974). (In Russian).

17054 THERMODYNAMIC PROPERTIES AND DOMAIN OF EXISTENCE OF URANIUM OXYSULFIDE. Dewally, D.; Perrot, P. (Univ. Lille, France). Compt. Rend., Ser. C; 278: No. 21, 1285-1287(20 May 1974). (In French).

The formation free enthalpy of UO was determined from C reduction equilibria and emf measurements, $\Delta G(UOS) = -206100 \pm 21.6T$ (cal). The UOS standard entropy is $S^0 = 22.5$ e.u. at 298°K. (FR)

17055 SUPERCONDUCTING PROXIMITY EFFECT OF NbN. Reppel, G. W.; Saur, E. J. (Univ. of Giessen, Ger.). J. Low Temp. Phys.; 17: No. 3-4, 287-293(Nov 1974).

Proximity effect sandwiches with NbN as type II superconductor and copper, silver, or gold as normal conductors were prepared. The transition temperature of the double layers investigated by resistivity measurements decreases with increasing thickness of the normal conductor. A maximal decline of 0.5°K was observed. The results are in qualitative agreement with theoretical expectations. (auth)

17056 THEORY OF A MAGNETIC COOLING SYSTEM AT VERY LOW TEMPERATURES. Goldstein, L. (Los Alamos Scientific Lab., NM). J. Low Temp. Phys.; 17: No. 3-4, 385-401(Nov 1974).

The totally anisotropic magnetic cooling compound, hydrated cerium magnesium nitrate, CMN, is treated at very low entropy values with the formalism of molecular-field theory. The magnetic phase-boundary line separating the ordered antiferromagnetic type region from the disordered paramagnetic region is well accounted for by the theory when compared with recent data of the Berkeley Low-Temperature Experimental Group. The ordered region refers to the canted antiferromagnetic or transverse magnetic field configuration of the Ce ions in CMN single crystals. One of the main experimental results refers to the temperature-scale functions obtained indirectly through largely arbitrary functions fitted to enthalpy–entropy data, treating simultaneously and indiscriminately both the ordered antiferromagnetic and disordered paramagnetic regions, with the data in the latter outweighing those in the former. The theoretical enthalpy–entropy function in the ordered range is in fair agreement with the corresponding data in absence of magnetic field with these data exceeding the calculated enthalpies. This may refer to the possible inclusion in the data of excitations in excess of the magnetic excitations alone accounted for by the theory. The entropy derivatives of the empirically fitted multi-parameter enthalpy–entropy functions define the indirectly derived temperature scales of strictly numerical significance at the very low temperatures. The molecular-field-theoretical entropy–temperature function, while approximate, is conceptually well grounded and may be preferable to, or at least competitive with, the indirectly derived Berkeley CMN temperature scales. There is fair agreement between them at the larger entropies approaching the zero magnetic-field critical transition entropy. (auth)

17057 TIME-DEPENDENT SOLUTION TO INTERSTITIAL DIFFUSION IN A TEMPERATURE GRADIENT. Lee, C. E.; Wallace, T. C. (Los Alamos Scientific Lab., NM). Nucl. Technol.; 25: No. 1, 124-137(Jan 1975).

An equilibrium thermodynamical model is developed for the time-dependent interstitial diffusion process in a temperature gradient in binary compounds. A new analytical solution is obtained from a linearization of the model. The linearized solution is in agreement (1 to 3%) with an accurate numerical solution of the nonlinear model and is significantly faster in evaluation. The sensitivity of this solution to parameter variations permits its use in detailed experimental comparisons. This new time-dependent solution makes possible, for the first time, an accurate, simultaneous determination of the chemical interdiffusion coefficients and the effective heat of transport of interstitial compounds, such as refractory carbides and hydrides, from a concentration measurement for short diffusion times. (auth)

17058 ELECTROLYTIC AND HIGH-TEMPERATURE REDUCTION OF SOLID SOLUTIONS BASED ON ZIRCONIUM DIOXIDE. Tikhonov, P. A.; Kuznetsov, A. K.; Keler, E. E.; Krasil'nikov, M. D. (Inst. of Silicate Chemistry, Leningrad). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 3, 372-374(Mar 1974).

Translated from Zh. Fiz. Khim.; 48: No. 3, 643-646(Mar 1974).

A comparative study of the high-temperature and electrolytic reduction of materials based on zirconium dioxide shows that the oxide and its solid solutions yield initially a non-stoichiometric phase with oxygen defects. Solid solutions with yttrium sesquioxide reduced by being heated in a vacuum to 2000 to 2200°C acquire considerable electronic conductance, which disappears when the specimens are oxidized and their composition approaches stoichiometric. Further electrolytic reduction forms not only the non-stoichiometric oxide phase but also a metallic phase based on zirconium. This is confirmed by differential thermal analysis and an electronic microprobe. When electrolytically reduced specimens are heated in air, the "metal" phase undergoes oxidation accompanied by an increase in mass, loss of metallic conduction, expansion, and softening of the material. (auth)

17059 BAND STRUCTURE OF CADMIUM–SELENIDE LAYERS AND SCATTERING PROCESSES OF HOT ELECTRONS. Adamchuk, V. K. Uch. Zap. Leningrad. Gos. Univ., Ser. Fiz. Nauk; No. 17, 48-61(1974). (In Russian).

The energy structure of cadmium selenide layers is determined by the methods of photoelectron and optical spectroscopy in the region of photon energies $h\nu < 11.8$ eV. The energies of the initial and final states are presented in the region of the Brillouin zone for the main photoelectron transitions. Primarily photoelectron excitation takes place because of direct transitions, but indirect electron transitions also contribute significantly to the optical excitation of cadmium selenide. Processes of electron-electron (interzonal) scattering become substantial on excitation of electrons by light having an energy $h\nu > 7$ eV. Estimates are given in the range of the photoelectrons to ionization by electron collision (Auger ionization). (tr-SJR)

17060 DENSIFICATION AND GRAIN GROWTH KINETICS OF URANIUM DIOXIDE IN THE INTERMEDIATE SINTERING STAGE. Glodeanu, F.; Georgeoni, P.; Galatchi, G.; Nicolaescu, I. V. (Inst. for Nuclear Tech., Budapest). Rev. Roum. Phys.; 19: No. 4, 437-444(1974).

The kinetic study of the densification and grain growth in the intermediate stage of sintering was performed on UO_2 pellets. The equation for the densification rate was written using as geometrical model for the grain shape the tetrakaidecahedron. On the samples there appeared the proportionality of the cube of grain diameter with time, which had already been predicted. The activation energy for pores removal was found to be equal to that for grain growth and in good agreement with those found by others as well as with those resulting from tracer diffusion experiments. (auth)

17061 MELTING POINT OF YTTRIUM OXIDE. Sheindlin, A. E.; Kenisarin, M. M.; Chekhovskoi, V. Ya. (Inst. of High Temperatures, Moscow). Dokl. Chem.; 216: No. 1-3, 364-365(May 1974).

Translated from Dokl. Akad. Nauk SSSR; 216: No. 3, 582-584 (May 1974).

Thermal analysis of heating and cooling curves of yttrium oxide was used to determine the melting point. Data on melting and solidification of Y_2O_3 show that phase transition in this compound occurs at 2430 ± 0.5°C. (JRD)

17062 PREPARATION AND CHARACTERIZATION OF RARE EARTH NITRIDES. Kaldis, E.; Zuercher, C. (Inst. for Solid State Physics, Zurich). Helv. Phys. Acta; 47: No. 4, 421-423 (1974). (In German).

Reactive evaporation was used for the preparation of thin layers of the nitrides of Sc, Eu, and Gd. The introduction of measurement probes allowed the in situ measurement of the electrical conductivity. The nitrogen content of the individual samples were determined by the Kjeldahl method. Measurements of the electrical conductivity of GdN and EuN layers showed the importance of impurities on the values obtained. A clear minimum in the pattern of optical density was obtained for all three nitrides. Large single crystals of GdN and HoN were prepared for the first time. Mass spectrographic studies showed that in the crystallization of GdN from the gaseous phase there is a sharp reduction in impurities. (JSR)

17063 PHOSPHATE LASER GLASSES CONTAINING OXIDES OF POLYVALENT ELEMENTS. Atanov, I. G.; Buzhinskii, I. M.; Koryagina, E. I.; Krasilov, Yu. I.; Polyakov, Yu. A.; Solokha, A. F.; Tsapkin, V. V.; Ellert, G. V. (Inst. of General and Inorganic Chemistry, Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 778-781(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 909-913(May 1974).

Properties of $Na_2O-P_2O_5-Nb_2O_5$ and $Li_2O-Na_2O-P_2O_5-Nb_2O_5$ glasses were studied. Results show that glasses containing up to 12 mole % Nb_2O_5 have low crystallization tendency and are stable. The glasses have good laser generation characteristics such as low threshold energy, high efficiency, and spectral density of coherent radiation. (JRD)

17064 DIFFUSION OF ZrC IN W AND OF Al_2O_3 IN Mo AND Nb. Borisov, E. V. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 799-800(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 932(May 1974).

The experiments were conducted using specimens produced by plasma deposition of W on ZrC plates and Al_2O_3 on Mo and Nb plates. Results show that these compounds diffuse as complexes of the Zr–C and Al–O type. (JRD)

17065 ELECTRICAL CONDUCTIVITY OF INDIUM AND THALLIUM OXIDES. Plotkin, S. S.; Plyushchev, V. E.; Zhuravlev, V. S.; Blinov, A. A. (Inst. of Fine Chemical Tech., Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 801(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 933(May 1974).

The electric conductivity of In_2O_3 and Tl_2O_3 specimens prepared from pure initial materials was measured. It was found that at 77, 293, and 573°K the electric conductivities of In_2O_3 are respectively

0.338, 1.12, and 4.67 mho/m, and the corresponding values for Tl_2O_3 are respectively 0.037, 0.26, and 0.894 mho/m. (JRD)

17066 YTTRIUM–VANADIUM–ALUMINUM GARNETS. Nedil'ko, S. A.; Golub, A. M. (Kiev State Univ.). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 808-809(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 940(May 1974).

The replacement of Al by V in Y–Al garnets was investigated. It was found that Y–V–Al garnets can be obtained by partial replacement of Al by V. Vanadium can replace only to Al atoms in $Y_3Al_5O_{12}$; this is accompanied by an increase in the lattice constant. (JRD)

17067 CREEP OF YTTRIUM OXIDE-BASED CERAMIC. Borovkova, L. B.; Lukin, E. S.; Poluboyarinov, D. N.; Bakunov, V. S.; Ryabtsev, K. I. (Moscow Chemical-Technological Inst.). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 812-813(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 942-943(May 1974).

Creep of compact Y_2O_3 and $Y_2O_3-ZrO_2$ ceramic specimens at 1450 to 1850°C and a load of 8 to 40 kg/cm^2 was investigated. Results are presented in graphs showing creep rate as function of temperature and stress. The rate is markedly affected by additions and the presence of impurities. (JRD)

17068 ROLE OF ALUMINUM IN ALKALI BORATE GLASSES, ACCORDING TO ESR DATA. Bogomolova, L. D.; Zhachkin, V. A.; Lazukin, V. N.; Shapovalova, N. F.; Shmukler, V. A. (Moscow State Univ.). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 820-822(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 950-951(May 1974).

The role of Al_2O_3 in $Cs_2O-Al_2O_3-B_2O_3$ glasses was studied. It was found that homogenization of the matrix occurs only when $Cs_2O/Al_2O_3 > 1$; otherwise the ESR spectrum is split into two types (III and IV). This shows that the glasses liquate in this region, one of the separating vitreous phases having a composition close to that of the homogeneous glasses forming here. (JRD)

17069 (PHASE EQUILIBRIUM IN THE SYSTEM Ti_3O-V. Maksimov, Yu. A.; Vavilova, V. V.; Kornilov, I. I. (Inst. of Metallurgy, Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 726-728(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 847-850(May 1974).

Results of studies show that the cross section Ti_3O-V of the ternary system titanium–vanadium–oxygen is quasibinary and is represented by a eutectic diagram. The temperature of the eutectic horizontal is 1520 ± 20°C; the eutectic contains 40 at.% vanadium. The solubility of vanadium in the suboxide Ti_3O at 600°C is 5 at.%. Doping of Ti_3O with vanadium reduces the melting point and microhardness. Determination of phase equilibrium in the system Ti_3O-V provides further confirmation of the individuality of the suboxide Ti_3O, which acts as an independent component of the system in this case. (auth)

17070 ACTIVATED SINTERING OF LANTHANUM HEXABORIDE POWDER TREATED WITH SHOCK WAVES AND ULTRASONICS. Meerson, G. A.; Nurmukhamedov, V. Kh.; Manelis, R. M.; Dremin, A. N.; Adadurov, G. A.; Breusov, O. N.; Pershin, S. V.; Tatsii, V. F. Fiz. Khim. Obrab. Mater.; No. 5, 140-144 (1974). (In Russian).

Intensification of the process of sintering of lanthanum hexafluoride powder, pre-treated with ultrasonic and shock waves, was studied. Roentgenograms of powders after different types of processing showed a broadening of the lines after explosive activation. This indicates a significant increase in the number of defects in the inner stresses in the particles. Subsequent sintering of the briquettes was more intensive, with a greater final density of the compression and a sharply decreased process temperature. (tr-auth)

17071 TEMPERATURE DEPENDENCE OF THE HARDNESS OF THE BORIDES OF TITANIUM, ZIRCONIUM, CHROMIUM, MOLYBDENUM, AND TUNGSTEN. Dzhemelinskii, V. V. Vestn. Kiev. Politekh. Inst., Ser. Mashinostr.; No. 10, 74-80(1973). (In Russian).

For transition metal borides TiB_2, ZrB_2, CrB_2, Mo_2B_5, and W_2B_5 determinations were made of: (i) the hardness temperature dependencies, (ii) activation energies for thermally activated slip—responsible for plastic deformation at high temperature, and (iii) the highest possible relative temperature for the brittle-to-plastic condition. These borides have lower values for (iii) than the carbides of refractory metals. (Ref. Zh.)

17072 GROWTH OF ZIRCONIUM CARBIDE MONOCRYSTALS BY THE METHOD OF PLASMA ARC FUSION. Savitskii, E. M.; Raskatov, N. N.; Kharkhardin, E. D.; Kruglov, V. N.; Poltoratskii, N. I.; Rymashevskii, G. A. (Inst. of Metallurgy, Moscow). Dokl. Akad. Nauk SSSR; 216: No. 6, 1263-1265(21 Jun 1974). (In Russian).

The suitability of the plasma-arc fusion method for the growth of zirconium carbide monocrystals was studied. It was shown that this method gives sufficiently coarse monocrystals with a composition close to stoichiometric and with a sufficiently uniform distribution of carbon. (JSR)

17073 MEASUREMENT OF THE DIFFUSION COEFFICIENT OF ELECTRONS IN WO_3 FILMS. Crandall, R.S.; Faughnan, B.W. (RCA Laboratories, Princeton, New Jersey 08540). Appl. Phys. Lett. 26: No. 3, 120-121 (1 Feb 1975).

Measurements of the electron diffusion coefficient in amorphous films of tungsten oxide give a value of $D=0.0025\pm0.0006$ cm^2 sec^{-1}. D decreases by less than a factor of 2 between +40 and −20 °C. (auth)

17074 ON THE STRUCTURE OF OXIDE FILM FORMED ON ZIRCONIUM AT 400 TO 500° IN OXIDATIVE MEDIUM. Vojtekhova, E. A.; Ivanov, O. S. pp 169-178 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 2. Zirconium-, Niobium- and Vanadium Alloys as Structural Materials of Various Purposes. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

2 Figs., 4 tables, 33 refs.

Samples of Zr oxidized at 400 to 500° in steam and air were studied by x-ray methods. It was shown that oxide films are formed on the surface of the metal. They have a pseudorhombic structure close to the structure of the monoclinic modification of ZrO_2. The pseudorhombic oxide was detected in very fine films formed on the metal in 1 hr at 400° and was preserved in very thick films as long as the film remained dense. It was assumed that the pseudorhombic oxides are polymorphic modifications of ZrO_2 whose existence is caused by the presence of high stresses arising during the growth of the oxide films. The removal of the stress (splitting of the films or its separation from the metallic base) leads to transformation of the pseudorhombic modification to the monoclinic. (tr-auth)

17075 STABILIZATION OF αUC_2 AND αMoC_{1-x} IN THE U–Mo–C AND U–W–C TERNARY ALLOY SYSTEMS. Alekseeva, Z. M.; Ivanov, O. S. pp 17-19 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

2 Figs., 8 refs.

By means of prolonged high-temperature annealing it was shown that alloying 1 at. % W or 3 at. % Mo leads to the stabilization of the low-temperature modification of UC_2 at room temperature. The addition of U does not prevent the decomposition of $\alpha-MoC_{1-x}$ and $\eta-MoC_{1-x}$ as a result of prolonged annealing, but stabilizes $\alpha-MoC_{1-x}$ in the cast alloy. (tr-auth)

17076 STRUCTURAL CHARACTERISTICS OF GROUND UO_2 PELLETS FOR NUCLEAR REACTORS. de Souza Santos, T.; de Freitas, C. T.; Haydt, H. M.; Gentile, E. F.; Ambrozio Filho, F. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Metalurgia Nuclear). Metalurgia (Sao Paulo); 29: No. 182, 45-51 (Jan 1973). (In Portuguese).

From 27th annual meeting of the Brazilian Association of Metals; Sao Paulo, Brazil (Jul 1972).

The characteristics of UO_2 powders and their utilization in the manufacture of high density sintered pellets for power reactors are described. The behavior of different ceramic powders from the standpoint of their most important physical and chemical properties and the microstructure of the pellets, sintered at 1625°C in hydrogen, as revealed by the scanning electron microscope are studied. The surface grinding of the pellets, done in centerless grinders in order to achieve the dimensional and surface roughness tolerances are studied. (INIS)

17077 INDEXING THE POWDER DIFFRACTION DIAGRAMS OF THE $UMoC_{2-x}$, UWC_{2-x} COMPOUNDS AND Z-PHASE OF THE U–W–C SYSTEM. Alekseeva, Z. M.; Ivanov, O. S. pp 19-26 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

4 Tables, 3 refs.

From a study of the monocrystals it was confirmed that $UMoC_{2-x}$ has an elementary cell of monoclinic system with the parameters a = 5.628 Å, b = 3.238 Å, c = 11.655 Å, β = 109°30′. In the $W_2C-C-UWC_2$ region of the U–W–C system z phase was detected which crystallizes in tetragonal cells with the parameters a = 8.327 Å and c = 3.137 Å. From a calculation of the interplanar spacing from the known parameters of the elementary cell and from a comparison of the calculated and experimental interplanar spacing, obtained from a calculation of the powder diagrams, the powder diagrams of $UMoC_{2-x}$, UWC_2, and the z phase were indexed. (tr-auth)

17078 NATURE OF THE ELECTRICAL CONDUCTIVITY OF Nd_2O_3 AT 500 TO 1000°C. Volchenkova, Z. S.; Chebotin, V. N. (Inst. of Electrochemistry, Sverdlovsk, USSR). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 7, 1092-1097(Jul 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 7, 1275-1280(Jul 1974).

From measurements of the electrical conductivity and transport numbers of ions by the emf method, the ionic and electronic components of the conductivity of neodymium oxide were calculated. Examination of the data and the defect structure of Nd_2O_3 show that at 500–1000°C and oxygen pressures of 10^{-4} to 1 atm, the electrical conductivity of Nd_2O_3 has an impurity character. Below 700°C, at $p_{O_2} < 10^{-2}$ atm and above 800°C at $p_{O_2} < 10^{-2}$ atm, the electronic conductivity is proportional to $p^{1/4}$ and $p^{1/6}$, respectively; below 700°C at $p_{O_2} > 10^{-2}$ atm it is independent of p_{O_2}. The ionic conductivity, due predominantly to oxygen vacancies, decreases with an increase in p_{O_2}, with the exception of the region of high temperatures and low pressures, where it is constant. (auth)

17079 FORMATION OF SOLID SOLUTIONS BY YTTRIUM OXIDE WITH ZIRCONIUM DIOXIDE AND HAFNIUM DIOXIDE. Karaulov, A. G.; Rudyak, I. N.; Taranukha, N. M.; Glushko, L. I. (Scientific-Research Inst. of Refractories, Kiev). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 7, 1098-1101(Jul 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 7, 1281-1285(Jul 1974).

Kinetics of formation of solid solutions was studied. Combination of yttrium oxide with ZrO_2 and HfO_2 begins at 700°C and obeys the Zhuravlev equation $\{\sqrt[3]{[100/(100-x)]}-1\}^2 = kz$. The activation energy of combination of yttrium oxide into solid solutions with ZrO_2 and HfO_2 is determined. At 1750°C, a 100% cubic phase is formed in the system $ZrO_2-Y_2O_3$ with 6 mole % Y_2O_3; in the system $HfO_2-Y_2O_3$ such a phase is formed when the Y_2O_3 content is 10 mole %. (auth)

17080 PROPERTIES OF CERTAIN OXYGEN COMPOUNDS OF GROUP-IV ELEMENTS. Sukhanov, N. M.; Krikorov, V. S.; Krasov, V. G.; Shevchenko, B. I.; Tverskova, V. A.; Strizhkov, B. V. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 7, 1163-1165 (Jul 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 7, 1356-1358(Jul 1974).

Monoxides of Si, Ge, Ti, Zr, and Hf were prepared and studied by x-ray, DTA, ir spectra, and dielectric properties. Results show that the monoxides are distinct compounds. Their oxidation to the dioxides was also studied; the lowest oxidation rates gave the most complete oxidation of TiO, ZrO, and HfO. The dioxides are good dielectrics. (DLC)

17081 MAGNETIC SUSCEPTIBILITY OF CERIUM ORTHONIOBATE. Kasimov, R. G.; Vovkotrub, E. G.; Smirnov, S. V.; Makurin, Yu. N. (Ural Polytechnic Inst., Sverdlovsk, USSR). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 7, 1168-1169(Jul 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 7, 1361(Jul 1974).

From the susceptibility measurements, the magnetic moment of $CeNbO_4$ is 2.61 μ_B, indicating that Ce is trivalent and Nb pentavalent. $CeNbO_4$, light mustard in color, was oxidized in air; the product, $CeNbO_{4.09}$, was dark brown and had a magnetic moment of 2.18 μ_B. The susceptibilities of both compounds are plotted vs temperature at 75 to 300°K. (DLC)

17082 SOLID SOLUTIONS IN THE SYSTEM ZrN–NbC. Gusev, A. I.; Shveikin, G. P. (Inst. of Chemistry, Sverdlovsk, USSR). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 7, 1087-1089(Jul 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 7, 1268-1271(Jul 1974).

The formation of a continuous series of solid solutions in the system ZrN–NbC was established. In the solid solutions, the number of defects in the nonmetal sublattice increases with the number of electrons of the M–M bonds. The microhardness of solid solutions of the system ZrN–NbC was investigated; the nonlinear character of its composition dependence was established. (auth)

17083 MACRO- AND MICROPLASTICITY IN THE FRACTURE OF CARBIDES OF THE TRANSITION METALS OF GROUPS IV AND V. Turchin, V. N.; Deryavko, I. I.; Emel'yanov, A. B.; Knyazev, V. I.; Lanin, A. G.; Rymashevskii, G. A. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 7, 1068-1071(Jul 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 7, 1245-1248(Jul 1974).

Experimental results are given on the microplasticity of Zr and Nb carbides appearing on impression of an indenter and during fracture. In both cases, the microplasticity increases with the test temperature; however, plasticity does not appear on the macro scale owing to the high defect content of the material and the high resistance to motion of dislocations at moderate temperatures ($<0.5\ T_m$). (auth)

17084 ANION VACANCY MIGRATION IN CaF_2 LATTICES AND IN MONOCLINIC ZrO_2. Van der Voort, E. (Commission of the European Communities, Ispra, Italy). J. Phys., C (London); 7: No. 22, L395-L399(21 Nov 1974).

Configurations of point defects in crystals are simulated by a computer program. Generalized Born potentials are used in order to calculate the total potential energy of some configurations. By minimizing the potential energy, the perturbed crystal may be relaxed. This yields a general working method for calculating the migration energies of these point defects. This method is used to investigate the migration of anion vacancies in some CaF_2 lattices (CaF_2, UO_2, and ZrO_2) and in monoclinic ZrO_2 with the following conclusions: (i) In the CaF_2 lattices the anion vacancies migrate only over ⟨100⟩ paths with an activation of 0.221, 1.976, and 1.425 eV for CaF_2, UO_2, and cubic ZrO_2 respectively; and (ii) In monoclinic ZrO_2, anion vacancies are more stable (2.21 eV) at OI sites than at OII sites. Bulk diffusion of this defect would have a sharp anisotropy along the b axis with a migration energy of 3.87 eV. These results are in contradiction with the facts observed in the oxidation behavior of Zr metal, so denying the bulk diffusion of anion vacancies through the oxide layer as a possible rate-controlling step for the oxidation. (auth)

17085 VACUUM HOT-PRESSING AND SOME PROPERTIES OF THE SYSTEM ZIRCONIUM DIBORIDE-REFRACTORY METAL COMPOSITES. Hirabayashi, M.; Nakagawa, M. (Electrotechnical Lab., Tokyo). pp 267-271 of International Conference on Vacuum Metallurgy. Tokyo; Iron and Steel Inst. of Japan (1974).

From 4th international conference on vacuum metallurgy; Tokyo, Japan (4 Jun 1973).

The densification processes of powder mixtures of zirconium diboride with refractory metals (Ta, Mo, and W) during vacuum hot-pressing were studied between 1600 and 2200°C under 300 kg/sq cm. The composition range investigated was from 5 to 95 wt % metal. The simple relationship $d\rho/dt = K(1\ \rho)$, or in its integral form $\ln(1\ \rho) = -Kt + \ln(1\ \rho_0)$ was used to characterize the hot-pressing behavior for powder mixtures of zirconium diboride with the low metal content (up to 10 wt %). The apparent activation energy for the intermediate stage of densification depended on the content of metal that was a lubricant for rearrangement of particles. Hot-pressed specimens were characterized by metallographic and x-ray diffraction analyses, and microhardness and electric resistivity were determined. (IAA)

17086 BORON AND BORON CARBIDE BY VAPOR DEPOSITION. Donaldson, J. G.; Stephenson, J. B.; Cochran, A. A. Electrodeposition Surface Treat.; 2: No. 2, 149-163(Jan 1974).

Stoichiometric amounts of BCl_3 and CH_4 were reacted with an excess of H at 1300°C. B_4C deposits were obtained with a sp gr of 2.32 (90% of the theoretical value for pure B_4C). The Knoop microhardness of one B_4C deposit on a mullite substrate was 3472. The deposit had a columnar microstructure. Reduction of BCl_3 by H at 1500°C on a graphite substrate gave strongly adherent coatings of B_4C with a Moh's hardness of ~9. The material has a potential use in rocket nozzles. (Metals Abstr.)

17087 MAKING OF PARTICULATE SPHERES. Wace, P. F. (to United Kingdom Atomic Energy Authority). US Patent 3,845,179. 29 Oct 1974. Priority date 9 Apr 1969, United Kingdom of Great Britain and Northern Ireland. 6p.

An apparatus for forming particulate spheres is described, wherein drops of a sol are caused to fall into a column containing a gelling liquid and the gelled drops are discharged at the bottom of the column at a controlled rate and hydraulically lifted and passed to washing and drying devices. (Official Gazette)

17088 BORAZON COMPACT CUTTING TOOLS. Hanneman, R. E.; Hibbs, L. E. Jr. Technical Paper No. MR73-143. Dearborn, MI; Society of Manufacturing Engineers (1973). 17p.

Superpressure sintering technology provided a feasible method for producing very dense, high-performance polycrystalline Borazon CBN (cubic boron nitride) and diamond cutting tool inserts sintered onto cemented carbide bases for rigidity and toughness. Comparison tests with conventional cemented carbide tools focused on the continuous turning of Inconel 718, René 95 and chill cast iron. Increases in machining rate, tool life, fatigue limit, and part tolerances, as well as improved surface finish and integrity, are reported for Borazon. The outstanding complementary performance for man-made diamond compact cutting tools in machining nonreactive, highly abrasive alloys such as Si–Al and fiberglass composites was demonstrated. The approach to making the tools incorporated such variables as the properties of the individual starting crystals, optimal size distribution, pretreatment of abrasive powders, chemical intermediates, effective substrates and design. Uses range from automotive to aerospace applications. (Metals Abstr.)

17089 CRUCIBLES FOR ELECTRON-RAY EVAPORATION OF ALUMINUM. Murashko, R. E.; Sumarokov, V. N.; Dubovik, T. V.; Kazakov, V. K.; Struk, L. I. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 12, 61-65(Dec 1974). (In Russian).

Production of crucibles for electron-beam evaporation of aluminium, from mixtures of various refractory compounds by hydrostatic pressing and sintering, is described. Results of crucible tests under conditions of vacuum evaporation of aluminium are given. Mixture compositions available to be used as a material for crucibles are established. (auth)

17090 REFRACTORY COMPOUNDS AS ELECTRODE MATERIALS. Gorenbein, A. E.; Skripnik, V. A.; Fedorovskaya, L. F.; Epik, A. P. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 222-225(1973).

An investigation was made of the electrochemical and corrosion behavior of several compounds of refractory metals (Ti and Zr borides, Ti and Mo disilicides as well as borided, silicided and carbidized Ti) under conditions of electrode polarization in a saturated solution of NaCl and also in nonaqueous solutions—several alcohols, ethylene chloride, nitrobenzene with simple halides and with complex compounds. Cathodes of silicided Ti, Ti silicide, Ti boride and carbidized Ti were corrosion resistant in NaCl. As anodes, none were resistant. In nonaqueous solutions all materials were essentially resistant except Cr boride in alcohol solutions. The cathodic polarization curves and discharge characteristics (coupled with active metals such as Zn and Al) indicate that the materials are satisfactory as electrodes in a wide temperature range (20 to–70°C) and can be used in electrochemical reduction of elementary Br and I. (Metals Abstr)

17091 ULTRAFINE OXIDE POWDERS PREPARED BY ELECTRON BEAM EVAPORATION. I. Evaporation and Condensation Processes. Ramsay, J. D. F.; Avery, R. G. (United Kingdom Atomic Energy Authority, Harwell, Eng.). J. Mater. Sci.; 9: No. 10, 1681-1688(Oct 1974).

Several ultrafine oxide powders (including ZrO_2, CeO_2, U_3O_8) were prepared by evaporation of bulk oxide with a focused beam of electrons, followed by condensation of the vapor. Rates of evaporation were dependent on the temperature of the heated zone and the corresponding vapor pressure of the oxide; they agreed with those predicted by the Hertz–Langmuir equation. The microstructure of the powders was affected by the pressure and type of gas present during condensation of the vapor. Particles which were nucleated in the vapor phase were unagglomerated and has an extremely small size ($\lesssim$ 10 nm) which was dependent on the rate of evaporation; at very low rates, sizes approaching the critical nucleus ($\lesssim$ 3 nm) were attained. (auth)

17092 SYNTHESIS AND PROPERTIES OF VANADIUM AND NIOBIUM DIHYDRIDES. Chertkov, A. A.; Padurets, L. N.; Mikheeva, V. I. (Inst. of General and Inorganic Chemistry, Moscow). Dokl. Chem.; 215: No. 1-3, 198-199(Mar 1974).

Translated from Dokl. Akad. Nauk SSSR; 215: No. 3, 610-611(Mar 1974).

Synthesis of $VH_{1.93}$, $VD_{1.93}$, $NbH_{1.82}$, and $NbD_{1.84}$ is reported. X-ray structure studies show that $VH_{1.93}$ is a single fcc phase while $NbH_{1.82}$ is primarily fcc phase with a small quantity of bcc phase. The vanadium and niobium dihydrides and dideuterides have a fluorite structure. (JRD)

17093 IMPROVEMENTS IN FLUIDISED BED APPARATUS. Lefevre, R. L. R. (to United Kingdom Atomic Energy Authority). British Patent 1,362,656/B/. 7 Aug 1974. Filed Date 24 Aug 1970. 4p.

The apparatus described comprises a fluidising chamber having a number of inlets for fluidising fluid in its base. Some of the inlets are located symmetrically about a central axis through the base and are inclined towards each other so as to discharge fluid in a number of streams, each with a relatively large vertical velocity component and a relatively small horizontal component, whereby material in the bed is rotated about the central axis. It is preferable that one of the inlets is located so as to discharge fluid vertically upwards along the central axis. Application of the apparatus for use in the production of coated particle nuclear fuels is described, and it is claimed that more uniformly coated particles are produced than has hitherto been practical. (UK)

17094 MANUFACTURE OF POROUS ARTICLES. Lefevre, R. L. R. (to United Kingdom Atomic Energy Authority). British Patent 1,362,786/B/. 7 Aug 1974. Filed Date 3 Sep 1970. 2p.

A method is described for the manufacture of materials having a predetermined degree of porosity from a powder or a slurry. The method can be used for the production of porous nuclear fuel bodies, and in particular the kernels of coated fuel particles. The method described comprises agglomerating particulate nuclear fuel material onto seed material, the latter being capable of imparting to the particles a voidage region of high porosity surrounded by the nuclear fuel material. Porosity may be developed when the material is heated to remove the seed, or the seed may comprise a porous inorganic material, having distributed porosity. An example is described of application of the process to UO_2 grains, using stearic acid as seed material. (UK)

17095 PROCESS OF MAKING NUCLEAR FUEL ARTEFACTS. Redding, G. B. (to United Kingdom Atomic Energy Authority). British Patent 1,362,991/B/. 14 Aug 1974. Filed Date 28 Jul 1971. 3p.

Reference is made to processes for making ceramic nuclear fuel bodies of low density. The process described consists of mixing together sintered ceramic nuclear fuel powder, unsintered ceramic nuclear fuel powder of smaller size range, and a binder to form a green compact, and heat treating the green compact to effect sintering of the unsintered powder, thus giving a wholly sintered body. The proportion of sintered powder in the green compact determines the final density of the product. Details are given for application of the process to the production of porous UO_2 bodies of size 0.5 inch thick and 0.5 inch diameter. The proportion of sintered powder in the mixture may lie between 25% and 1% by weight. (UK)

17096 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. D'Eye, R. W. M.; Shennan, J. V. (to United Kingdom Atomic Energy Authority). British Patent 1, 362,834/B/. 7 Aug 1974. Filed Date 5 Dec 1968. 1p.

Reference is made to fuel members for cluster-type fuel assemblies comprised of fuel elements consisting of SiC sheathed rods, with means interposed between the sheath and fuel for absorption of fission fragments and for preventing reaction between sheath and fuel. In the elements described, the interposing means consists of C obtained by carbonising a resin coating on the interior of the sheath or graphite produced by further heating of the C, or preferably from graphite suspended in the resin. This C interlayer is to be distinguished from pyrolytic C interlayers previously proposed, which tend to be deposited unevenly. The resin may comprise phenol–formaldehyde, which gives strongly adherent coatings up to thicknesses of 0.005 in. after curing and carbonising. (UK)

17097 EFFECT OF PRODUCTION CONDITIONS ON SUPERCONDUCTING PROPERTIES OF NIOBIUM NITRIDE. Samsonov, G. V.; Shulishova, O. I.; Shcherbak, I. A. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 12, 76-78(Dec 1974). (In Russian).

A study was made of the effect of nitrogen pressure, temperature nitriding time, and metal briquette density on the transition temperature and its width of niobium nitride. Change in the relative volume of samples in the process of nitriding was investigated. Optimal conditions were determined for obtaining niobium nitride with a transition temperature of 15.4°K and width 0.1°K: nitrogen pressure 5 atm nitriding time 3 h, temperature 1400°C, porosity of briquette of metal niobium 20%. (auth)

17098 NEW TERNARY BORIDES WITH STRUCTURES OF $CeCo_3B_2$ AND $CeCo_4B$ TYPE. Val'ovka, I. P.; Kuz'ma, Yu. B. (Lvov State Univ., USSR). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 11, 1029-1031(Nov 1974). (In Ukrainian).

New ternary compounds in the systems U–{Fe, Co, Ni}–B were found by means of x-ray diffraction analysis. The borides UCo_3B_2 (a = 4.956, c = 3.072 Å) and UFe_3B_2 (a = 5.051, c = 2.997 Å) have the structure of the $CeCo_3B_2$ type. The crystal structure of the borides UCo_4B (a = 4.889, c = 6.939 Å) and UNi_4B (a = 5.053, c = 6.998 Å) belong to the $CeCo_4B$ structure type. (auth)

17099 LIMITING WORKING TEMPERATURE OF HEATER ELEMENTS OF CURRENT-CONDUCTING CERMETS. Koftelev, V. T. Porosh. Met., Akad. Nauk Ukr. SSR; No. 12, 57-60(Dec 1974). (In Russian).

Factors are considered influencing the limiting theoretically possible working temperature of heaters made of current-conducting cermets of the refractory metal–refractory oxide type. An expression was obtained which permits the limiting working temperature to be estimated for various cermets. It is shown that the limiting working temperature may be increased by such means (in order of diminishing importance): using oxide phase with high isolation properties and cermets with low resistivity at temperature 0°C, applying metal with high thermal resistance coefficient, increasing the porosity and concentration of the metal in cermet. The cermets include those of Nb, Mo, and ZrO_2. (auth)

17100 ELECTRONIC STRUCTURE AND PHYSICAL PROPERTIES OF LANTHANOID OXIDES: A REVIEW. Samsonov, G. V.; Gil'man, I. Ya. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 11, 73-83(Nov 1974). (In Russian).

Literature data on main physical properties of lanthanoid oxides in comparison with the peculiarities of electronic structure of lanthanoids and oxygen is reviewed. Physical properties of lanthanoid oxides are shown to be determined by the character of distribution of valent electrons of lanthanoid and oxygen ions into localized and non-localized electrons and by probability of formation of constant electronic configurations (f^0, f^7, f^{14} and s^2p^6) by them. (50 references) (auth)

17101 CATHODE SPUTTERING AND SECONDARY IONIC EMISSION OF REFRACTORY BORIDES. Samsonov, G. V.; Morozov, V. V.; Kunitskii, Yu. A.; Vasil'ev, M. A.; Ivashchenko, Yu. N.; Cherepin, V. T. (Kiev Polytechnical Inst.). Porosh. Met., Akad. Nauk Ukr. SSR; No. 11, 61-63(Nov 1974). (In Russian).

Results are given of an investigation of cathode pulverization and secondary ionic emission of refractory borides appearing during argon-ion bombardment with energy 7 keV. (auth)

17102 OBTAINING PHASE ANODE NIOBIUM OXIDE. Bogoyavlenskii, A. F.; Lipatova, N. E. (Kazan Aviation Inst.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 12, 1766-1768(1974). (In Russian).

The possibility of obtaining enamel phase anode Nb oxides with a thickness of 100 and more microns was shown experimentally. The test data indicated the following condition for obtaining phase anode Nb oxides: electrolyte of 10% H_2SO_4 with addition of 20 g/l of NaF, D_a = 1 A/dm², temperature of 20°C, and time of 1 h. (tr-auth)

17103 SINGLE CRYSTALS OF $T-Nb_2O_5$ OBTAINED BY SLOW COOLING METHOD UNDER HIGH PRESSURES. Tamura, S.; Kato, K.; Goto, M. (National Inst. for Researches in Inorganic Materials, Ibaraki, Japan). Z. Anorg. Allg. Chem.; 410: No. 3, 313-315(Dec 1974).

The T form of niobium(V) oxide was prepared in clear crystals at 1800°K and 20 kbar in the presence of water as mineralizer. The sample was free of F, Cl, and OH. Lattice constants and x-ray data are given. (auth)

17104 CHEMICAL PROPERTIES OF NITRIDES OF THE CERIUM SUBGROUP LANTHANIDES. Lyutaya, M. D.; Goncharuk, A. B.; Gordienko, S. P. (Inst. of Problems in Materials Science, Kiev). Ukr. Khim. Zh.; 40: No. 11, 1140-1145(Nov 1974). (In Russian).

The stability of La, Ce, Pr, and Nd nitrides was studied at room temperature in air when heated in oxygen, in water, in NaOH solution, and in sulfuric, hydrochloric, and nitric acids. The results of the study were evaluated from chemical, x-ray, and mass-spectrometric data. Nitrides are decomposed in air with release of ammonia and formation of metal hydroxides, which then react with carbon dioxide of the air to form basic carbonates. The nitrides studied are completely oxidized in oxygen at 80 to 330°C with formation of metal oxides. Studies on the stability of nitrides in air and in oxygen showed cerium nitride has the lowest stability. The chemical bond in the rare earth nitrides is discussed on the basis of data obtained in these studies and found in the literature. (tr-auth)

17105 EFFECTS OF 3 MeV ELECTRONS ON CdS, ZnTe, AND PbTe. Baltateanu, N. (Inst. of Atomic Physics, Bucharest); Spinulescu, I. Stud. Cercet. Fiz.; 26: No. 7, 701-713(1974). (In Rumanian).

The effects of 3 MeV electrons on the crystalline structure and electric resistivity of CdS, ZnTe, and PbTe semiconductor thin films are investigated by electron diffraction. Thin films with oriented crystallites (texture) were examined. Radiation effects the orientation degree of the microcrystallites in these films, obtained by vacuum evaporation under various technological conditions were studied. It was found that the irradiation effects are strongly dependent on the conditions of sample preparation and particularly on the substrate temperature and degree of cleanness and on the pressure in the evaporation enclosure. (auth)

17106 BOND STRENGTH CONSIDERATIONS APPLIED TO CATION COORDINATION IN NORMAL AND HIGH-PRESSURE OXIDES. Shannon, R. D. (E. I. du Pont de Nemours, Wilmington, DE); Chenavas, J.; Joubert, J. C. J. Solid State Chem.; 12: No. 1-2, 16-30(1 Jan 1975).

For cations with radius ratios close to the critical value of .414, 2 rules are developed to predict a preference for tetrahedral or octahedral coordination: (1) If for $M_aX_bO_c$ the ratio $\gamma = a/b$ is greater than a certain critical value (generally $\gamma_c \cong 1.0$), X prefers tetrahedral coordination; (2) the greater the M–O bond strength, the greater the tendency for octahedral coordination of X. These rules follow from a consideration of Pauling's electrostatic valence rule and reflect the probability of having strong M–O bonds to compete with X–O bonds. The coordination of Te^{6+}, V^{5+}, As^{5+}, Ge^{4+}, Ti^{4+}, Fe^{3+}, Ga^{3+}, Al^{3+}, B^{3+}, Be^{2+}, and Zn^{2+} in many oxides are consistent with these rules. Exceptions occur when the cations are found in highly stable structures such as perovskite, spinel, quartz, garnet, scheelite, and K_2SO_4. When applied to high-pressure transitions these rules allow the prediction that small γ values and strong M–O bonds will lower the pressure at which an increase in the coordination of X should occur. (auth)

17107 INFLUENCE OF SiO_2 ON SINTERING OF PARTIALLY STABILIZED ZIRCONIA. Shackelford, J. F.; Nicholson, P. S.; Smeltzer, W. W. (McMaster Univ., Hamilton, Ont.). Amer. Ceram. Soc. Bull.; 53: No. 12, 865-867(Dec 1974).

Silica significantly enhanced the sintering of zirconia partially stabilized with CaO and with MgO. Increasing the SiO_2 content from 0 to 2 wt% in a 3.5 wt% CaO-partially stabilized ZrO_2 increased the fired shrinkage from 12 to 26% and the fired density from 3.45 to 4.85 g/cm³. Similar enhancement was found for 2 wt% MgO-partially stabilized ZrO_2. The sintering behavior of fully stabilized ZrO_2 (>5 wt% CaO or 3.5 wt% MgO) was much less affected by silica. The stabilizer and SiO_2 impurity concentrated at the grain boundaries. Possible mechanisms of sintering enhancement are discussed. (auth)

Metals and Alloys

Refer also to abstract 18787.

17108 (GEMP-177B) HIGH-TEMPERATURE MATERIALS AND REACTOR COMPONENT DEVELOPMENT PROGRAMS. Volume II. Materials. Second Annual Report, November 15, 1962–December 31, 1962. (General Electric Co., Cincinnati, Ohio (USA). Nuclear Materials and Propulsion Operation). 28 Feb 1963. Contract AT(40-1)2847. 283p. Dep. NTIS $17.25. Declassified 21 Sep 1973.

Research and development are reported on ceramic fuel elements, metallic fuel elements, graphite fuel element materials, reactor control materials, reflector materials, shielding materials, and direct conversion materials. (JRD)

17109 (HEDL-TME-74-3(Vol.1)) HEDL QUARTERLY TECHNICAL REPORT, JULY–SEPTEMBER 1974. Volume 1. Applied Research and Materials Engineering. Evans, E. A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-2170. vp. AT.

Research results are reported on ceramic fuels, neutron absorber materials, stress-rupture of 316 stainless steel, FFTF and LMFBR weld materials, radiation effects on 316 stainless steel, and sodium technology. (JRD)

17110 (ORNL-TM-2020) FUELS AND MATERIALS DEVELOPMENT PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1967. Patriarca, P. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Feb 1968. Contract W-7405-eng-26. 194p. Dep. NTIS $12.75.

Research progress is reported on development of Sol-Gel fuel for LMFBR, fuel element fabrication, mixed nitride fuels, nondestructive testing, SAP development, Zr metallurgy, weldability of Ni-bearing alloys, radiation effects on fuel materials, and radiation effects on alloy and structural materials. (JRD)

17111 (RISO-304) METALLURGY DEPARTMENT PROGRESS REPORT, 1 JANUARY–31 DECEMBER 1973. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jun 1974. 51p. Dep. NTIS (US Sales Only) $5.75.

Research progress is reported on properties of single-phase and two-phase materials, zirconium alloys, fuel elements, radiation effects on stainless steels, automatic tube inspection, and international programs. (JRD)

17112 (RN-S-0393) NERVA MATERIALS DEVELOPMENTS SECOND QUARTER, CONTRACT YEAR 1967 (1 JANUARY–31 MARCH). (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1967. 84p. Dep. NTIS $7.25.
Activities pertaining to materials and processes development for the NERVA program during the second quarter of Contract Year 1967 are discussed. Topics include materials investigations related to the space environment, wear and friction, radiation damage, boron analysis, austenitic alloy properties, turbopumps, valves, pressure vessels, nozzles, test facilities, drawings, and new technology. (auth)

17113 (RN-S-0463) NERVA MATERIALS DEVELOPMENTS. Second Quarter, Contract Year 1968 (1 January–31 March). (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1968. 78p. Dep. NTIS $7.00.
Activities pertaining to materials and processes development for the second quarter of Contract Year 1968 are described. Topics include materials investigations related to wear and friction, radiation damage, space environment, and activities in support of engine components and of facilities at both Aerojet, Sacramento, and NRDS, Nevada. (auth)

17114 (RN-S-0477) NERVA MATERIALS DEVELOPMENTS. Third Quarter, Contract Year 1968 (April, May, and June 1968). (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1968. 88p. Dep. NTIS $7.50.
Activities pertaining to materials and processes development topics include materials investigations related to wear and friction, radiation damage, space environment, and activities in support of engine components and of facilities at both AGC, Sacramento, and NRDS, Nevada. Accomplishments include: stress-rupture tests of irradiated Inconel 718 and Wappalog; tensile tests of irradiated Hastelloy X and Al alloys 7039-T61 and -T64; stress corrosion tests of 7039-T61 and 6061-T6; and prevention of internal oxidation during welding of stainless-steel lines. (DLC)

17115 LOW TEMPERATURE PHYSICS: LT 13. Volume 3. Superconductivity. 13th International Conference Held at Boulder, Colorado, August 21–25, 1972. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corporation (1974). 846p. (CONF-720833-(P3)). $35.00.
Approximately 162 papers were presented at the conference. A separate abstract was prepared for each paper. (JRD)

For abstracts of individual papers see: 17040–17048, 17229–17333, 17514–17519, 17545, and 18356–18396.

17116 STUDY OF THE ELECTROCHEMICAL POLISHING OF TANTALUM. Ippolitova, L. A.; Korovin, N. V. Elektrokhimiya; 10: No. 4, 517-520(Apr 1974). (In Russian).
A study was made of the behavior of Ta during electropolishing in an ethylene glycol solution of HF and H_2SO_4. The experimental data showed that at current densities <100 mA/cm^2, the polishing of Ta depends on the formation of a viscous pre-anodic layer consisting of dissolution products. However, at current densities >100 mA/cm^2, the polishing effect is achieved as a result of the periodic formation and breakdown of an anodic passive layer as in the case of Ni, steel, and other metals. (Metals Abstr.)

17117 STAINLESS STEEL AND NICKEL ALLOY TUBES FOR NUCLEAR POWER GENERATION. Egnell, L. (Sandvik AB, Sweden). J. Brit. Nucl. Energy Soc.; 13: No. 4, 375-381(Oct 1974).
The underlying qualities determining the choice of stainless steels and nickel alloys for steam generators or fuel element canning service are discussed. Special emphasis is given to steam generator application for PWR, HTR, and LMFBR reactors. Some Fe–Cr–Ni alloys are of particular interest. Alloy 800 with modifications for PWR and HTR steam generator tubes is expected to offer satisfactory resistance to stress corrosion. Other proprietary alloys of lower Ni content have high creep strength and are of interest as potential HTR superheater materials, or as LMFBR canning material. The importance of proper tube manufacturing facilities and procedures is illustrated by reference to the production of PWR steam generator tubes. (UK)

17118 BORON/ALUMINUM FOR SPACE APPLICATIONS. Robertson, A. R.; Miller, M. F. (General Dynamics Corp., San Diego, CA). pp 361-368 of Sixth National SAMPE Technical Conference. Vol. 6. Azusa, CA; Society for Advancement of Material and Process Engineering (1974).
From sixth national SAMPE technical conference on materials on the move; Dayton, Ohio, USA (8 Oct 1974). See CONF-741058-.
Several experimental boron/aluminum structures were built for aircraft and space vehicle applications. The success of these structures has led to the decision to use boron/aluminum tubular struts on the mid-fuselage section of the Space Shuttle Orbiter. The suitability of boron/aluminum for this application has been demonstrated in a program that involved fabricating 100 tubes and performing static, fatigue, corrosion, thermal/mechanical fatigue, and damage tolerance tests on them. Other potential applications for boron/aluminum on the Space Shuttle include the wing carry-through panels and side panels for the mid-fuselage, and the landing gear struts. These applications result in significant weight savings over conventional non-composite designs at moderate costs. Boron/aluminum can now be considered a production material that, in many cases, is competitive on a weight and/or cost basis with an all-metal or resin composite system. (auth)

Corrosion and Erosion

Refer also to abstracts 17033 and 19040.

17119 (AI-AEC-13132) SODIUM TECHNOLOGY AND COVER GAS SEAL DEVELOPMENT PROGRAMS. Annual Technical Progress Report, Government Fiscal Year 1974. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Aug 1974. Contract AT(04-3)-824. 296p. AT.
Activities in programs to conduct friction screening tests in an environment of high-temperature, high-purity liquid sodium or sodium vapor are reported. These programs are directed to development of backup materials, processes, and vendors for FFTF core component wear pads. Other research progress is reported on improvement of wear behavior of LMFBR materials, evaluation of bearing materials, statistical evaluation of friction properties of hardfaced materials, sodium technology, and FFTF–LMFBR reactor vessel seals. (JRD)

17120 (COO-2313-2) LIQUID LITHIUM CORROSION RESEARCH. Progress Report, April 1–December 31, 1974. Olson, D. L.; Bradley, W. L. (Colorado School of Mines, Golden (USA)). 1974. Contract AT(11-1)-2313. 102p. Dep. NTIS $8.25.
Ground boundary penetration and weight loss kinetics were determined for both 304L and nitrided 304L stainless steels in liquid lithium. A delay time, observed before penetration starts, was associated with the incubation of the corrosion product. The penetration kinetics was found controlled by the grain boundary diffusion of lithium. Titanium gettering of the liquid lithium was found to reduce both penetration and weight loss. The weight loss had a duplex behavior with a thermally activated uniform corrosion followed by an irregular surface deterioration. An analytical technique to determine the nitrogen concentration in the liquid lithium has been developed. Grain boundary grooving kinetics of iron in liquid lithium was determined with iron diffusion in the liquid lithium being the controlling process. Penetration and creep behavior were investigated for stressed iron in liquid lithium and the stress enhanced penetration was found to be controlled by creep. The activation energy for penetration and creep was shown to be essentially the same as for self diffusion of iron. A model for this stress enhanced penetration was proposed. (auth)

17121 (ICP-1036) CORROSION OF AUSTENITIC STAINLESS STEEL ALLOYS DUE TO HNO_3–HF MIXTURES. Cole, H. S. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs–Operations Office). Oct 1974. Contract AT(10-1)-1375. 47p. Dep. NTIS $4.00.
A literature survey and results of experimental work on the corrosion of austenitic stainless steel alloys due to HNO_3–HF mixtures are presented. Most of the available data were obtained during the processing of spent nuclear fuel elements where solutions containing nitrates and fluorides are frequently encountered. Austenitic stainless steels have been extensively used in nitrate–fluoride solution service in these plants. It has been shown that their service may be improved by: (1) proper annealing; (2) stabilizing with niobium or titanium; (3) complexing the solutions the stainless steels are exposed to with aluminum, zirconium, or thorium; (4) utilizing stainless steels which have a low carbon content; (5) maintaining the uncomplexed hydrofluoric acid in the solution at as low a value as practicable; and (6) utilizing neutron absorbing elements in the alloys at concentrations as low as possible for service as fixed nuclear poisons. Other protective measures such as reduced contact time, temperature, concentration, and fluoride-to-nitrate ratio can be employed to minimize corrosion. (auth)

17122 (RFP-2251) INVESTIGATIONS OF WELDED URANIUM-6 WEIGHT PERCENT NIOBIUM BINARY ALLOY. Mah, R.; Kochen, R. L.; Brandon, E. D. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 25 Oct 1974. Contract AT(29-1)-1106. 18p. Dep. NTIS $4.00.

The mechanical properties, along with the corrosion and stress-corrosion cracking resistance of welded uranium-6 weight percent niobium, were investigated. The mechanical properties were determined using tensile bars and Charpy impact specimens. The corrosion and stress-corrosion cracking investigation was conducted in oxygen-saturated water containing 50 parts per million chloride ions. The best mechanical properties were obtained from the underaged material. The environmental tests showed that although no evidence of stress-corrosion cracking was found, selective corrosion and pitting were observed. Findings show that variations in postweld and preweld heat treatments and in welding parameters also produced diverse corrosion resistances. (auth)

17123 (RN-S-0221) OXIDATION OF AISI 347 IN OXY-HYDROGEN ATMOSPHERES. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1965. 26p. Dep. NTIS $4.50.

Oxidation tests were conducted on 0.040-in. dia wire samples of AISI 347 stainless steel at the three oxy-hydrogen weight ratios of 8/1 (stoichiometric), 5/1 and 2/1 (both hydrogen rich). For each ratio, the samples were exposed at 2000, 2200, and 2350°F for 10, 20, and 40 minutes. Pressures used were 530 and 0 psig. Conditions of pressure, temperature, exposure time, and atmosphere selected were as severe or more severe than the actual chemical firing conditions experienced in the NERVA nozzle. Velocity effect was not evaluated in these tests. (8 figures) (auth)

17124 (RN-TM-0393) FRICTION EVALUATION OF MATERIALS FOR VALVE APPLICATIONS. Lamvermeyer, D. J. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1966. 22p. Dep. NTIS $4.25.

Adhesion and friction tests were conducted on candidate metal lip seal, valve gate, and coatings material combinations under equivalent contact stress, surface velocity, temperature, and atmosphere conductions. The materials were: Inconels 718 and X-750, gold plating, "electrolize" coating, "Dicronite" coating. It is recommended that the optimum materials combination be an "electrolize" coated Inconel 718 valve gate in contact with a 500-μin. thick gold plate on a hardened 302 stainless steel lip seal, and that lip seal gold coating thicknesses of 1000 to 2500 μin. should be evaluated for improving valve seal leakage. (DLC)

17125 (SAND-74-5170) ZIRCONIUM–OXYGEN PHOTOFLASH REACTION AT OXYGEN PRESSURES FROM 1 TO 124 ATMOSPHERES. Nelson, L. S.; Northrup, C.J.M. Jr.; Wemple, R. P.; Richardson, N. L.; Fastle, D. J.; Planner, H. N.; Keil, K. (Sandia Labs., Albuquerque, N. Mex. (USA); New Mexico Univ., Albuquerque (USA)). [nd]. 26p. (CONF-741049-1). Dep. NTIS $4.50.

From meeting of the Western States Section/The Combustion Institute; Northridge, California, USA (21 Oct 1974).

The zirconium wool-oxygen photoflash reaction has been studied in oxygen at pressures from 1 to 125 atmospheres. The luminous emission was studied with photomultiplier and calibrated photographic spectroscopic techniques; also, the reactions were photographed using a high speed camera. The wool combustion is a highly chaotic process occurring as a summation at any given instant of individual droplets with varying diameters having reacted to different degrees. Vapor phase-related phenomena (explosions, halos, and smoke deposition) are suppressed or reduced at higher oxygen pressures, probably due to the increased hydrostatic forces. The light emitted increases in peak intensity (2-fold in the red to 4.5-fold in the blue), and decreases in pulse width and pulse asymmetry as the oxygen pressure is increased from 1 to 125 atmospheres. At the same time, the average peak radiance temperature increases from about 3600 to 4400°K. The emission approximates a blackbody to within ± 3% even at the highest pressures, but the temperature falls considerably below that expected from published vapor pressure/temperature relationships for the zirconium–oxygen system. (auth)

17126 (WANL-TME-1324) KINETICS OF THE ZIRCONIUM–CARBON REACTION AT TEMPERATURES ABOVE 2000°C. Adelsberg, L. M.; Cadoff, L. H.; Tobin, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1965. 24p. Dep. NTIS $4.25.

The reaction between liquid zirconium and graphite at temperatures above 2000°C has been investigated. The reaction products were found to be carbon-saturated zirconium metal and ZrC which formed between the graphite and the metal. Parabolic growth behavior was observed for the ZrC phase at all temperatures of this investigation. The parabolic growth constant at temperatures between 2000 and 2860°C was measured to be 1.83 exp (−84,300/RT) cm^2/s. The reaction mechanism was proposed to be the rapid carbon saturation of the liquid metal and the formation of ZrC at the metal-carbide interface with diffusion of carbon through the ZrC the rate determining step of the reaction. The concentration independent diffusion coefficient of carbon in ZrC, (D_C^{ZrC}), was proposed to be 0.95 exp (−78,700/RT) cm^2/s. This value was calculated using the temperature invariant ZrC phase fields proposed in the literature. The [Zr(liq)] − [Zr(liq) + ZrC] phase boundary over the temperature range 2000 to 2800°C was determined. The ZrC + C eutectic temperature was found to be 2890 ± 50°C. (auth)

17127 BEHAVIOR OF MATERIALS IN A VACUUM ENVIRONMENT. Chuan, R. L.; Wallace, D. A. (Celesco Industries, Inc. Costa Mesa, CA). pp 197-200 of International Conference on Vacuum Metallurgy. Tokyo; Iron and Steel Inst. of Japan (1974).

From fourth international conference on vacuum metallurgy; Tokyo, Japan (4 Jun 1973).

The effects of space environment on metals and nonmetals are discussed, covering the effects of vacuum and radiations, alone and in combination, on zinc, cadmium, magnesium, lubricants, solar cell material, coatings, and S-13G material. Window glass transparency deterioration caused by equipment-related air contamination is noted, while the natural environmental effects of space on spacecraft materials are found to be negligible. (IAA)

17128 ZIRCONIUM OXIDATION BY OXYGEN AT LOW PRESSURE. Example of Mixed Dissolution-Diffusion Kinetics. Azzopardi, M.; Caillet, M.; Sarrazin, P.; Besson, J. (Ecole Nationale Superieure d'Electrochimie et d'Electrometallurgie, Grenoble, France). J. Chim. Phys.; 71: No. 6, 858-864(Jun 1974). (In French).

Under the assumption that the oxidation rate of zirconium by oxygen under low pressures is controlled by the dissolution and the diffusion of oxygen in the metal, relations giving the rate law and the pressure law of this reaction are derived from the general set of equations describing the system. Calculations from these equations are in good agreement with the experimental results of Dechamps and Lehr. (FR)

17129 CORROSION OF TITANIUM–TANTALUM–MOLYBDENUM ALLOYS IN 50% SULFURIC ACID AT 20°C. Shmakov, N. M.; Mikheev, V. S.; Lishcheta, L. I.; Sabynina, R. F.; Turyanskaya, E. G. Khim.-Farm. Zh.; 7: No. 10, 37-43(1973). (In Russian).

Corrosion–time tests and electrochemical polarization tests were made for Ti–Ta–Mo alloys with Ta + Mo contents of 1.6, 2.8, 4.0, 4.8, and 8.0% in 50% H_2SO_4 at 20°C. The lowest corrosion rate was given by Ta + Mo = 8%, and this alloy also exhibited the lowest current density in the polarization tests. (Metous abstr.)

17130 SULFIDATION AND SULFIDATION–OXIDATION OF NICKEL- AND COBALT-BASE ALLOYS CONTAINING DISPERSIONS OF STABLE OXIDES. Stringer, J. (Univ. of Liverpool); El-Dahshan, M. E.; Wright, I. G. Oxidation Metals; 8: No. 6, 361-377(Dec 1974).

The presence of a fine dispersion of a stable oxide is known to have a beneficial effect on the oxidation resistance of nickel- and cobalt-base heat-resisting alloys. Preliminary experimental results are presented relating to the hot-corrosion resistance of these alloys. Alloys forming Cr_2O_3 scales appear to be resistant to oxidation when coated with sodium sulfate, whereas an alloy normally forming an Al_2O_3 scale suffers accelerated attack. During sulfidation some of the alloys suffer an accelerated degradation, with sulfur penetrating rapidly along what appear to be grain boundaries. The same effect is noted in sulfidation–oxidation experiments, when the Cr_2O_3-forming alloys suffer accelerated oxidation, the effect of the dispersoid being apparently removed. An Al_2O_3-forming alloy resists this form of attack well. The sodium sulfate-coated test is probably a good guide to the behavior under weakly corroding conditions, whereas the sulfidation–oxidation test may give a better indication of the behavior under highly aggressive conditions. (auth)

17131 NUMBER OF REGULARITIES OF THE PERMEABILITY OF STEEL SHELLS WITH RESPECT TO DEUTERIUM WHICH IS FORMED DURING CORROSION IN HEAVY WATER STEAM AT HIGH TEMPERATURES AND PRESSURES. Kurdyumov, A. A.; Belyakov, Yu. I.; Zvezdin, Yu. I. Uch. Zap. Leningrad. Gos. Univ., Ser. Fiz. Nauk; No. 17, 102-107(1974). (In Russian).

Studies were carried out on the hydrogen permeability of steel shells during corrosion in superheated steam of heavy water. It is shown that the deuterium flux through the shell depends exponentially on the shell temperature, and practically does not depend on the steam pressure. It was found that within a certain interval of thicknesses the deuterium flux under given conditions does not depend on thickness. A hypothetical model is proposed to explain these phenomena. (tr-SJR)

17132 MECHANISM OF THE INCREASE IN THE STABILITY OF THE PASSIVE STATE OF CHROMIUM–NICKEL STEELS IN THE CASE OF ALLOYING WITH SMALL QUANTITIES OF MOLYBDENUM AND COPPER. Bozin, N. A. J. Appl. Chem. USSR (Engl. Transl.); 47: No. 6, 1452-1454(Jun 1974).

Translated from Zh. Prikl. Khim.; 47: No. 6, 1412-1414(Jun 1974).

The passivation (electrochemical) behavior in sulfuric acid was studied for the following steels: $Cr_{19}Ni_{28}Mo_3$, $Cr_{19}Ni_{28}Mo_3Cu_3$, $Cr_{23}Ni_{28}Cu_3$, $Cr_{23}Ni_{28}Cu_3Mo_1$, and $Cr_{23}Ni_{28}Cu_3Mo_3$. Results show that alloying with Mo and Cu shifts the static potential toward positive values, and that Cr and steel pass from the metastable to the stable passive state. (DLC)

17133 KINETICS OF INTERACTION OF Nb WITH DIFFERENT GASES AT LOW PRESSURES AND HIGH TEMPERATURES. Lein, F. Ya.; Ermakova, M. P.; Nesterenko, A. G.; Martinson, E. N.; Gekov, A. F.; Arakelov, A. G. Fiz. Khim. Obrab. Mater.; No. 5, 27-31(1974). (In Russian).

The kinetics of Nb interaction with residual gases in a vacuum, taking the individual gases in pure form and in a mixture at 1×10^{-4} and 1×10^{-6} mm Hg and 400 to 1200°C. The interaction rate in the linear part of the kinetic curves increased in the order: N_2, CO, H_2O vapor, air, 50% N_2 to 50% O_2, O_2. The reaction coefficient was determined. It was shown that the retardation effect of the passive gas (N_2) results in a decrease in the partial pressure of the active gas (O_2). (tr-auth)

17134 KINETICS OF THE OXIDATION OF TANTALUM AND ZIRCONIUM BY ALTERNATING CURRENT. Kondrashin, V. Yu.; Malygin, V. V.; Shatalov, A. Ya. Elektrokhimiya; 10: No. 4, 577-580(Apr 1974). (In Russian).

A study was made of the influence of frequency, time, and current density on the ac oxidation of Ta and Zr by aerated 0.1 N H_2SO_4 solution. The film thickness initially increased slowly with time but the rate later became linear. The rate of oxidation increased linearly with current density, but there was a critical value of the polarizing current, below which oxidation did not take place, and which depended on the nature of the electrode material and the conditions of oxidation. In contrast, increasing the ac frequency produced a linear fall in oxidation rate and there was a critical frequency above which the oxidation process did not take place. (Metals Abstr.)

17135 SURFACE CONDITION OF WC–Co ALLOYS AFTER SUBJECTION TO FRICTION IN LIQUID NITROGEN. Shnyrev, P. D. Fiz. Khim. Obrab. Mater.; No. 5, 86-88(1974). (In Russian).

The results are presented of studies on the effect of the sliding rate on the wear of WC–Co alloys in tests in a liquid nitrogen medium. It was shown that, within the rate range 0.14 to 0.4 m/s, the wear of alloys type VK 6 increases, reaches a maximum, and then drops. Data from a micro mechanical test and x-ray structural analysis indicated a deformation strengthening of the friction surface. (tr-auth)

17136 EFFECT OF ALLOYING ADDITIONS ON THE CORROSION STABILITY OF NICKEL–MOLYBDENUM ALLOYS IN SOLUTIONS OF HYDROCHLORIC AND SULFURIC ACIDS. Akshentseva, A. P.; Shvarts, G. L.; Makarova, L. S.; Gerasimenko, G. I.; Kardonov, B. A. Khim. Prom. (Moscow); No. 2, 52-54 (1974). (In Russian).

The corrosion stability of EP 814 Ni–Mo alloys with V and low concentrations of C and Fe and EP 495 alloys with varying concentrations of B, Re, and V was studied in solutions of HCl and H_2SO_4 at temperatures from 95 to 120°C. The alloys with 0.005 to 0.015% B and with 0.3 to 0.9% Re had the best corrosion stability in the two acids. Alloys containing V were corrosion resistant only in HCl solutions. (JSR)

17137 EFFECT OF HEAT TREATMENT UPON THE STRESS CORROSION CRACKING OF MULBERRY (U-7.5 Nb–2.5 Zr). Weirick, L. J. (Sandia Labs., Livermore, CA). Corrosion; 31: No. 1, 5-14(Jan 1975).

Stress corrosion cracking (SCC) and mechanical property data were taken on Mulberry specimens heat treated at preselected temperatures to obtain representative microstructures. Results show that, in general, the higher the temperature of the heat treatment is, the more α-uranium is produced in the microstructure, the higher the mechanical strength is, and the more resistant the material is to SCC. Mechanisms are presented to explain the effect of the microstructure on both the initiation and propagation of stress corrosion cracks. (auth)

17138 EFFECT OF AGING AND IRRADIATION ON THE CORROSION OF ZR–2.5 Wt % Nb. Urbanic, V. F. (Atomic Energy of Canada Ltd., Chalk River, Ontario); Lesurf, J. E.; Johnson, A. B. Jr. Corrosion; 31: No. 1, 15-20(Jan 1975).

In the absence of radiation the corrosion of quenched, cold worked and aged Zr-2.5 Wt % Nb in 280°C pressurized water decreases with increasing aging time and temperature. Under neutron irradiation the corrosion in all aged conditions is much less, and no dependence on prior aging is discernible. The corrosion behavior is compared with the submicrostructure developed during thermal aging and subsequent irradiation. On aging the quenched and cold worked structure, β-Nb precipitates from the α-Zr phase, reducing the Nb concentration in the matrix. It is postulated that the corrosion suppression under irradiation is due to in-reactor aging. (auth)

17139 INTERGRANULAR CORROSION AND EMBRITTLEMENT OF FERRITIC STAINLESS STEELS. Demo, J. J. (E. I. du Pont de Nemours and Co., Wilmington, DE); Bond, A. P. Corrosion; 31: No. 1, 21-22(Jan 1975).

Problems involved in using commercial ferritic stainless steels are discussed. These problems are intergranular attack due to sensitization, embrittlement of the alloy in certain temperature ranges, control of the carbon and nitrogen contents, and carbide stability. Several areas in which future research programs can be directed are described. (auth)

17140 PROTECTING NIOBIUM AND TANTALUM AGAINST CARBURIZATION. Zhunkovskii, G. I.; Evtushok, T. M. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 232-235(1973).

The interaction of Nb and Ta with C at high temperature leads to undesirable changes in mechanical properties. One method of protection is to create coatings of refractory compounds on the surfaces. The most stable refractory compounds in relation to C are NbB_2 and TaB_2. The interaction of such boride layers with both the metallic subtrate and with C containing substances (graphite, lampblack in vacuum and lampblack in H) was investigated. Regardless of the physical condition of the C-containing medium, no signs of interaction were observed in the first few hours of holding time in a given temperature range. A later interaction appears to be due to processes occurring in the diboride itself. The relationship between the stability of boride phases and the physical condition of the C and the atmosphere (vacuum, H) is analysed. (Metals Abstr.)

17141 ABSORPTION SPECTRA FOR THIN FILMS OF ZIRCONIUM DIOXIDE. Shalimova, Kh. V.; Margulova, T. Kh.; Malova, T. I.; Malov, M. M.; Klimova, S. M. Sov. At. Energy (Engl. Transl.); 36: No. 4, 391-392(Apr 1974).

Translated from At. Energ. (USSR); 36: No. 4, 312-313(Apr 1974).

The effects of Trilon B on corrosion of Zr-base alloys by water were studied. It was found that samples oxidized in water solutions of Trilon B at 300°C for 2 and 5 hr form films 0.08 and 0.12 μ thick respectively while those oxidized in water under similar conditions form films 0.17 and 0.21 μ thick. The absorption spectra of the films are analyzed. (JRD)

17142 LAWS GOVERNING THE PROCESS OF INTERNAL OXIDATION OF ALLOYS WITHOUT FORMATION OF EXTERNAL OXIDES ON THE SURFACE. Shmykov, A. A. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 61-69(1973).

Internal oxidation occurs by diffusion of atoms (anions) of O from the surface into the interior of the metal solvent and counter-diffusion of ions (cations) of the dissolved alloying element, with formation of finely dispersed oxide particles. It is one method of strengthening metals and alloys. The mechanism of internal oxidation without formation of external oxides is defined and diagrammed. The laws governing the process are derived from an analysis of diffusion equations. Examples are given for Cu–Zr, Ag–Zr, and Ag–In alloys. Similar conditions can be developed for Ni and Au alloys with microadditions of certain elements. (Metals Abstr.)

17143 REACTIONAL DIFFUSION DURING OXIDATION OF TUNGSTEN ALLOYS IN AN ATMOSPHERE WITH A HIGH CONCENTRATION OF NITROGEN. Lazareva, I. Yu.; Prokoshkin, D. A.; Vasil'eva, E. V.; Skotnikov, S. A. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 57-60(1973).

The mechanisms of high-temperature oxidation of alloys in gas mixtures containing N differ, depending on whether N is an active component with respect to the specific material (i.e., forms chemical compounds or solid solutions) or whether its effect on the system is similar to that of an inert gas that inhibits adsorption of O on the surface of the alloys. The kinetics and mechanisms of reactional diffusion were investigated in alloys of W with Ti, V, Nb, Ta, and Re (up to 50% each) during oxidation in air with increasing N pressures. The results are tabulated and discussed. The direct methods commonly used for determining N concentration (Kjeldahl and vacuum fusion) did not give reliable results for oxides, so a special spectral emission method was developed. (Metals Abstr.)

17144 TRANSITION PHENOMENON. A Hypothesis Concerning the Behavior of Zr and its Alloy During Corrosion in Steam. Tolksdorf, E. (Danish Atomic Energy Commission, Risoe). Corros. Sci.; 14: No. 10, 565-573(Nov 1974).

The validity of a proposed transition theory was investigated by exposing a variety of Zr alloys to 500°C superheated steam. The transition theory is based on oxidation of intermetallic particles in the oxide at specific oxygen partial pressures. The experiment showed that the theory was valid for those alloys possessing intermetallic particles in the oxide. Those alloys with no particles were dominated by hydrogen absorption and an apparent hydride instability at the metal/oxide interface. (auth)

17145 CORROSION OF MATERIALS IN NUCLEAR REACTORS. Bratescu, I. D. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 10, 1049-1060(1974). (In Rumanian).

In reactors, the corrosion of the materials of which the installations are made, occurs, as well as corrosion of fuels. This process of corrosion is undergone by iron and its alloys, uranium and its compounds, as well as the component metals of different alloys such as: chromium, zirconium, beryllium, tantalum, magnesium, natrium, niobium, hydroxide of sodium, and fluorides. The reactions undergone by these metals corrosion processes produce: Fe_2O_3, $(Na_2O)_2$, FeO, Fe_2C, Fe_2C_9, FeO, FeOOH, BeO, ZrO_2, Cr_2O_3, Na_2CrO_4, $Na_2Cr_2O_7$, Ta_2O_5, Na_2O, MgO, NbO_2, Be_2C, ZrC, and UC. Most often, these corrosion products do not permit the good functioning of equipment, and pollute the products that are to be obtained as well. It is advisable to try to use high-quality raw materials, correct manufacturing methods, and to strictly observe the parameters indicated in the method. (auth)

17146 CORROSION-ELECTROCHEMICAL PROPERTIES OF MOLYBDENUM IN ACIDIC MEDIA. Neiman, N. S.; Kolotyrkin, Ya. M.; Knyazheva, V. M.; Plaskeev, A. V.; Dembrovskii, M. A. (Physicochemical Inst., Moscow). Dokl. Phys. Chem.; 216: No. 4-6, 588-590(Jun 1974).

Translated from Dokl. Akad. Nauk SSSR; 216: No. 6, 1331-1334(Jun 1974).

The corrosion and electrochemical behavior of Mo in HCl and H_2SO_4 solutions were studied. Results show that Mo can be used as a corrosion-resistant material and as an alloying element for alloys used in acid media under conditions where a potential of approximately ≤ 0.30 volts can be maintained. (JRD)

17147 FATIGUE-CRACK PROPAGATION BEHAVIOR OF TYPE 304 STAINLESS STEEL IN A LIQUID SODIUM ENVIRONMENT. James, L. A.; Knecht, R. L. (Westinghouse Hanford Co., Richland, WA). Met. Trans.; 6: No. 1, 109-116(Jan 1975).

The fatigue crack growth of Type 304 stainless steel in a liquid sodium environment at 800 and 1000°F was characterized using a linear-elastic fracture mechanics approach. Tests were conducted in low (<2.0 ppM) and high (20 to 40 ppM) oxygen sodium and the results were compared with those of tests conducted in vacuo and in air. Similar crack propagation characteristics in air at room temperature and at elevated temperatures in sodium and vacuum is evidence that the thermally activated component of crack propagation observed in air is an environmental effect. Related work on environmental effects on fatigue or crack propagation properties are reviewed and discussed. (auth)

17148 CARBONIZATION OF AUSTENITIC STEELS IN A SODIUM COOLANT. Starkov, O. V.; Luk'yanova, I. N. Prot. Metals (USSR) (Engl. Transl.); 10: No. 3, 238-242(1974).

Translated from Zashch. Metal.; 10: No. 3, 255-260(1974).

On the basis of investigations of the carbonization of the austenitic steels 1Kh18N10T and 1Kh16N15M3B at 500 to 700°C in sodium containing various sources of carbon, the values of the kinetic parameters of carbonization were obtained. The influence of the ratio of the areas of the carbon source and absorber on the rate of absorption of carbon is established, and a model for analyzing the carbonization process is proposed with the aim of determining the permissible service lives of thin-walled components made of austenitic steels. (auth)

Preparation and Fabrication

Refer also to abstracts 17089 and 17579.

17149 (ANCR-1189) THERMAL NEUTRON FILTER CADMIUM ELECTROPLATE PROPERTIES. Beeston, J. M. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Dec 1974. Contract AT(10-1)-1375. 34p. Dep. NTIS $4.00.

Properties of thick cadmium electrodeposited on steel plate and tubing are compared for three principal baths: a standard bath, an Owen's bath, and a sulfamate bath. Some baths produced a brittle plate, e.g., the standard bath, while the Owen's and sulfamate baths produced a ductile plate than can experience a strain of about 20% without cracking. The plate was heated to 400°F without roughening or blistering from release of absorbed gas. Properties investigated were the bend and tensile, x-ray diffraction, hydrogen and impurity content, and microstructure. (41 fig) (auth)

17150 (RN-S-0530) WELDABILITY INVESTIGATION OF ALUMINUM ALLOYS FOR USE IN NERVA LINES. Fletcher, C. W. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1969. 26p. Dep. NTIS $4.50.

Weldability evaluation of seven aluminum alloys was accomplished. Data are tabulated on the alloys investigated, with reference to the form and section thickness in which the material was obtained, the calculated wall thickness required for NERVA design yield strengths, and typical alloy tensile strengths. In all instances where the NERVA-line-design section thickness could not be obtained for a particular alloy, substitute thicknesses in excess of the design requirements were accepted. In those cases, the plate or tube weldment was machined to the required thickness prior to welding. A total of 32 plates and 18 tube weldments were completed and inspected by penetrant and radiographic inspection methods. Data on the base-alloy filler-wire alloy combinations which were investigated are also included. (auth)

17151 (WANL-TME-628) DEVELOPMENT OF A GOLD PLATING PROCESS TO WITHSTAND A 1350°F BRAZING CYCLE. Hanzlik, H. O.; Ricks, H. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Dec 1963. 21p. Dep. NTIS $4.25.

The localized or brush plating process evaluated is not suitable for this application (gold plating of NRX-A-1 instrumentation) because neither the amount or composition of solution or the rate of deposition can be controlled well enough to obtain the required high-quality plate. A standard, properly operated electroplating process which involves a nickel strike, gold strike and gold plate (as described by WANL 294582-1) produces a surface compatible with the 1350°F brazing process. Maintenance of proper cleaning and striking conditions are essential to assure bonding. (auth)

17152 (WANL-TME-910) EVALUATION OF METALLURGICAL PROCESSES FOR FABRICATION OF ALUMINUM CORE SUPPORT BARREL. Stemann, L. G. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Aug 1964. 31p. Dep. NTIS $4.75.

Processing of 2219 aluminum alloys for the production of core support barrels presented a number of serious problems. This alloy, while generally considered weldable and fabricable from other standpoints, had not previously been used on this type of part. Original plans for use of material in the T3 welded and aged to T8 condition, were abandoned due to questionable weld ductility and problems in dimensional sizing in the as-welded condition. Heat treat procedures were revised to resolve this problem. Quality fusion welding was found to be directly related to cleanliness and preparation. Gradual tooling improvements and tighter controls were needed to eliminate fusion weld defects beyond specification limits. Resistance welding presented no such problem and was accomplished to the requirements of MIL-W-6858. Chemical cleaning prior to resistance welding required considerable development effort. Vendor limitations made the development of a single active cleaning bath, with appropriate rinsing operations a necessity. A cleaning or deoxidizing operation of this type was developed and successfully applied. (auth)

17153 (WANL-TME-1120) LOW TEMPERATURE BRAZING OF TANTALUM TO STAINLESS STEEL FOR THERMOCOUPLE APPLICATION. Stemann, L. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1965. 15p. Dep. NTIS $4.00.

The fabrication of refractory metal thermocouple assemblies requires the joining of tantalum to stainless steel. Vendors responsible for making these parts had encountered difficulty with this joint and defective items had been produced. A series of pre-coating cycles were developed for inclusion in a vendor's manufacturing process which would facilitate wetting by low temperature braze alloys. The most successful of these precoats was a silver plate on the tantalum which was adherent both before and after brazing. (auth)

17154 (WANL-TME-1404) ELECTRON BEAM SPOT WELDING OF INSTRUMENTED TIE ROD ASSEMBLIES. Stemann, L. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 12p. Dep. NTIS $4.00.

A technique for electron beam spot welding of Inconel 718 alloy has been developed. By modification of existing equipment characteristics and close control of weld time; parameters were achieved which produced sound, defect free joints. The developed technique was used in the fabrication of instrumented tie rod assemblies. Minimum heat affected zone, controlled penetration, and dimensional tolerances were critical limitations in this application. (auth)

17155 (WANL-TME-1731) CHEMICAL VAPOR DEPOSITION OF THORIATED TUNGSTEN PROTECTIVE CUPS. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1968. 36p. Dep. NTIS $4.75.

A manufacturing process was developed for chemically vapor codepositing, in production quantities, a tungsten 2% thoria alloy into a protective cup configuration from gaseous phases. WF$_6$ and thorium acetylacetonate were used as the active plating species, H$_2$ as the metal reductant, and CO$_2$ as the thorium oxidizer. The cups were deposited on expendable male Mo mandrels that were machined precisely to the required inside dimensions of a finished cup. Since the plated W bonds intimately onto the Mo mandrel, the inside surface of the cup conforms exactly to the outside dimensions of the mandrel. The mandrels were removed by chemmilling. As fabricated, the cups were extremely frangible as evidenced by the columnar and poorly defined grain structure. A stress-relieving heat treatment at approximately 2000°C recrystallized the grains into an equiaxed fine grain structure that was resistant to grain growth after heating to 2200°C for 5 h. It appeared that the thoria was present as a super fine dispersion within the grains of tungsten as manifest by the resistance of the material to grain growth and property degradation at elevated temperatures. The stress-relieving heat treatment reduced the hardness from approximately 800 to 350 KHN, resulting in a readily machinable material. Preliminary strength measurements of this material indicate an ultimate tensile strength of approximately 135,000 psi at room temperature, and 8100 psi at 2400°C. At the conclusion of this program, PDS 30103 was written to define the process for controlling the quality of CVD (chemical vapor deposited) thoriated tungsten protective cups. (19 figures) (auth)

17156 (WANL-TME-2701) COPPER-BORON-10 CONTROL VANES FOR NERVA REACTORS. Process Development and Properties. Shogan, R. P.; McAndrew, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1970. 35p. Dep. NTIS $4.75.

A copper–boron material has been developed for NERVA control vane application and successfully produced for PAX use. Processing includes fluidized-bed mixing of the copper and enriched boron-10 powders, isostatic compaction, extrusion, rolling, die forming, and electrical discharge machining. A reduction in boron content and the addition of a vacuum heat treatment prior to extrusion have facilitated the production process. Physical and mechanical properties obtained to date are reported. (auth)

17157 (Y-DA-5858) ELECTROSLAG REFINING OF URANIUM ALLOYS. Lewis, P. S. Jr. (Oak Ridge Y-12 Plant, Tenn. (USA)). 17 Sep 1974. Contract W-7405-eng-26. 15p. (CONF-741078-1). Dep. NTIS $4.00.

From fifth international symposium on electroslag and other special melting technology; Pittsburgh, Pennsylvania, USA (16 Oct 1974).

The use of electroslag remelting in a scrap recycle process to purify U and μ alloys by removal of oxide inclusions was investigated. Results show that: Large oxide inclusions in uranium and uranium alloys can be eliminated by electroslag remelting. The oxygen content of uranium and uranium alloys can be reduced by electroslag refining with a CaF$_2$–Ca metal slag. Complete melting of the slag materials is readily achieved in dry starts with CaF$_2$–Ca metal slag mixes. The Ca metal requirements are based upon the total oxygen content of the electrode metal and the slag materials. (JRD)

17158 METHOD FOR OBTAINING PURE BORON AND DEVICE FOR CARRYING OUT SAID METHOD. Naslain, R. R.; Soum-Pouyalet, B. G.; Etourneau, J. R.; Hagenmuller, P. J. (to Agence Nationale de Valorisation de la Recherche). French Patent 2,178,799/A/. 7 Apr 1972. 21p. (In French).

A combination of reducible boron is reduced by means of gaseous hydrogen at 1000 to 1100°C, in a vertical reactor comprising a bed of porous boron pellets maintained in the fluidized state by the reaction gaseous mixture. The boron thus obtained is quite pure. The method can be applied to the preparation of pure boron in the state of porous, and chemically highly reactive, pellets. (FR)

17159 PRECIPITATION PROCESS TAKING PLACE IN TYPE K 32 Nb STEEL DURING PROLONGED ANNEALING. Eysymontt, J.; Wiedermann, J. (Pr. Inst. Hutn.; 24: No. 5, 277-281(1972). (In Polish).

The effect of prolonged annealing heat treatment in the tempering temperature range on the precipitation process and on the structure of low-C steel of K 32 Nb-type (C 0.162, Mn 1.04, Si 0.38, P 0.021, S 0.009, Ni 1.13, Cr 0.27, Cu 0.62, Mo 0.31, Ti 0.01, V 0.02, and Nb 0.056%) was studied by optical and electron transmission microscopy, and x-ray measurements. The sheet samples were normalized at 910°C for 2 h to a ferritic-pearlitic structure containing a small proportion of bainite, and $\sim$12% of residual austenite, then annealed at 550, 690, and 650°C for 10, 50, and 100 h. After prolonged annealing, the precipitate consisted mainly of cementite, which indicated that the Cu remained in solid solution thus influencing the strength by promoting a distortion in the crystallographic lattice of α–Fe. (Metals Abstr.)

17160 DETERMINATION OF PARAMETERS OF HEAT TREATMENT OF TYPE K 32 Nb STEEL SHEETS BY STRUCTURAL ANALYSIS. Eysymontt, E. B.; Schwedler, A. Pr. Inst. Hutn.; 24: No. 4, 187-196(1972). (In Polish).

Structural changes and the precipitation of carbides as a function of the temperature of heat treatment are studied by optical, and electron microscopy, x-ray micro- and phase analyses, and radioautography in Cu steel Type K 32 Nb containing Cu 0.62, C 0.16, Mn 1.04, Si 0.38, P 0.02, Ni 1.13, Nb 0.056, Mo 0.31, V 0.02, Cr 0.27, and Ti 0.01%. The optimal tempering temperature (600°C), structure of tempered steel, and oxidation of steel are discussed. (Metals Abstr.)

17161 USE OF ELECTROPLATED SILVER COATING FOR THERMODYNAMIC INVESTIGATIONS IN REACTOR TECHNOLOGY. von Holzen, G.; Saxer, W. (Oberflaeche-Surface; 15: No. 2, 35-40(Feb 1974). (In German).

To simulate thermodynamic conditions in reactors, stainless steel heater tubing was plated with high-purity Ag in axially varying thicknesses. A plating chamber containing the annular Ag electrode and the flowing electrolyte is moved along the tube at variable velocities to produce layer thicknesses from 0.02 mm to 0 mm. The tubes were cleaned conventionally and plated with a thin Ni layer, followed by an Au layer. A cyanide electrolyte was used at 20°C with a current density varying <0.1%. The electrical resistance of simulated heating elements prepared in this manner varied by <1%. (Metals Abstr.)

17162 BERYLLIUM WINDOWS JOINED BY ELECTROPLATING. Johnson, H. R.; Dini, J. W. (Sandia Labs., Livermore, CA). Rev. Sci. Instrum.; 46: No. 1, 109-110(Jan 1975).

Beryllium windows, 76 mm diam and 0.25 mm thick, were joined to stainless-steel flanges by electroplating the joint area with nickel. The procedures for surface preparation of both materials and the technique used for joining the materials with nickel are described. Electroplated joints made with this method have proved to be vacuum tight to helium. By using this technique, shrinkage stresses, distortion, and recrystallization problems associated with high-temperature joining processes are eliminated. (auth)

17163 EFFECT OF GROWTH RATE ON THE STRUCTURE OF Mo MONOCRYSTALS. Gartman, M. V.; Glebovskii, V. G.; Kopetskii, Ch. V.; Shmyt'ko, I. M. Fiz. Khim. Obrab. Mater.; No. 5, 50-52(1974). (In Russian).

The substructure of 8-mm-dia Mo monocrystals, grown by electron-beam zone melting without a crucible, was shown to depend on the growth rate. At low rates (0.5 mm/min), a strongly polygonal structure was formed, while at high rates (up to 6 mm/min) the polygon boundaries disappeared and the substructure appeared as separate cells of etching. Radial heterogeneity was observed. The results are explained by movement of the dislocations in the field of axial and radial temperature gradients of the growing crystal. (tr-auth)

17164 INTROSPECTIVE ANALYSIS OF FILIFORM CRYSTAL GROWTH IN V, Nb, AND Mo. Taskaev, I. P. Fiz. Khim. Obrab. Mater.; No. 5, 53-58(1974). (In Russian).

Introspective analysis of the growth of filiform crystals based on the vortex mechanism of growth, i.e., a theoretical analysis of growth of specimens for a priori determination of the possibility of growing such crystals under the stated conditions and finding the optimum conditions for growing them, showed why it is difficult to grow such crystals of W, Mo, and Nb by ordinary methods. From the analysis it was possible to find a suitable construction of the growth zone which ensures vortex formation and production of samples and the growth conditions needed for growing whiskers in a gas stream. The equipment, especially that for supplying the feed to the growth zone, should have rigid specifications. (tr-auth)

17165 STUDY OF ROLLING TUBULAR MATERIALS IN A VACUUM. Report 2. Polukhin, P. I.; Krupin, A. V.; Kolikov, A. P.; Potapov, I. N.; Larin, E. N.; Kozeradskii, S. A.; Gladkov,

V. I. (Moscow Inst. of Steel and Alloys). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 9, 80-84(1974). (In Russian).

Results are presented on a study of high-temperature longitudinal rolling of tubular molybdenum material on a vacuum rolling mill. It was established that it is possible to achieve radial-spiral and longitudinal rolling of tubular material made of molybdenum obtained by various methods. Sticking of metal to the roller was investigated during radial-spiral rolling in vacuum and in an inert gas medium on a rolling mill MISiS-50. Under these conditions there is no sticking of metal to the roller. However, with longitudinal rolling of tubular material in vacuum, sticking of metal to the roller is observed. In this regard it was necessary to subject the roller to a special treatment, for example, to boriding. (SJR)

17166 AMPLITUDE OF VIBRATION OF AN ELECTRON BEAM AND ITS EFFECT ON THE SHAPE AND SIZE OF THE FUSION ZONE. Ryzhkov, F. N.; Bashkatov, A. V.; Uglov, A. A. Fiz. Khim. Obrab. Mater.; No. 5, 14-19(1974). (In Russian).

Expressions are given for determining the amplitudes of sinusoidal, rectangular, and saw-tooth vibrations of an electron beam and also in its circular and elliptical movement in welding. The increase in the amplitude of vibration as a result of astigmatism of the duration results in distortion of the zone of fusion and a change in its dimensions. (tr-auth)

17167 DEVELOPMENT OF WELDING TECHNIQUES AND MATERIALS. Bellettre, R. Sci. Tech. (Paris); No. 13, 36-44 (15 Apr 1974). (In French).

Welding methods in current use are described, including arc welding, resistance welding, welding by electron and laser beams, ultrasonic welding, explosive welding, diffusion welding, and brazing. Suitable techniques are discussed for welding constructional steels, high-strength steels, Al and its alloys, Cu and its alloys, Ti, Zr, and Ta and their alloys, taking account of the associated metallurgical problems. (Metals Abstr.)

17168 OBTAINING FOILS AND FILMS OF SELENIUM, GERMANIUM, AND MANGANESE ISOTOPES FOR NUCLEAR RESEARCH. Nazarova, T. S.; Rozen, A. A. (Physicotechnical Inst., Kharkov). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 892-893(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 226(1974).

A procedure is described for obtaining films having a thickness ranging from 0.1 to 5 μ on various substrates and free foils having a thickness $\delta = 5\ \mu$ of Se, Ge, and Mn isotopes by vaporization of compact metal from a tantalum or tungsten vaporizer. (auth)

17169 OPTIMIZING THE THERMAL TREATMENT OF A HIGH-TEMPERATURE RARE EARTH ALLOY CONTAINING COBALT AND COPPER. Livshits, B. G.; Samarin, B. A.; Tsertsvadze, J. V. (Moscow Inst. of Steel and Alloys). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 9, 132-135(1974). (In Russian).

An alloy of the following composition was investigated: 28.6% Sm, 4.7% Pr, 43.5% Co, 17.0% Cu and 6.2% Fe which corresponds to the formula $Sm_{0.85}Pr_{0.15}Co_{3.3}Cu_{1.2}Fe_{0.5}$. By proper planning of the experiments it was possible to find the following optimum mode of thermal treatment by a relatively small number of experiments: an homogenization temperature of 910°C, a cooling rate of 0.3°S, an annealing temperature of 300°C, and an annealing time of 3 h. In this case the following magnetic properties were obtained for the alloy: ${}_BH_C = 5650$ Oe; $B_r = 6850$ gs; $(BH)_{max} = 11.8 \times 10^6$ gs. (SJR)

17170 COMPARISON OF LAPPING AND LINISHING AS SAMPLE-PREPARATION TECHNIQUES FOR THE X-RAY FLUORESCENCE ANALYSIS OF LAW-ALLOW STEELS. Tunney, A. A. (British Steel Corp., Sheffield, Eng.). Brit. Steel Corp., Open Rep.; vp(1973).

The method described earlier (cf. Analyt. Abstr., 1972, 23, 4604) has been used for determining Si, Mn, P, S, Cr, Mo, Ni, Nb, Sn, Ti, V and Zr in samples that had been (a) lapped for 15 min with 220-grit boron carbide, then cleaned with solvents, or (b) linished with 60-grit alumina disks. Over-all 95% confidence limits have been calculated for both types of treatment, and relationships of coefficient of variation to concentration of each element have been investigated. The findings show that the precision depends largely on the procedure for setting up the instrument and that lapping affords no improvement in precision compared with linishing. The more rapid linishing technique is therefore recommended for use in production control analyses. (Anal. Abstr.)

17171 DEVELOPMENT OF ARGON ARC MELTING TECHNIQUES FOR THE PREPARATION OF SOLID SPECIMENS (OF STEEL) FOR INSTRUMENTAL ANALYSIS FROM DRILLINGS. Tunney, A. A.; Hughes, H. (British Steel Corp., Sheffield, Eng.). Brit. Steel Corp., Open Rep.; vp(1973).

Samples were melted in an atmosphere of Ar and cast in moulds (maximum dia 38 mm; depth 3 mm). The resulting buttons were linished or lapped before analysis by x-ray fluorescence or optical emission spectrometry for Si, Mn, P, S, Cr, Mo, Ni, Cu, Nb, Sn, Ti, V, Zr, C, Al, and B. Comparative analyses carried out on cast buttons and on the original millings or drillings showed that the re-melting technique can be used for the determination of all the elements listed, apart from Zr, in steel. Losses that arise in the determination of C, Si, Mn, P, and S can be corrected for in the calibration procedure or, more simply, by the use of correction factors. (Anal. Abstr.)

17172 INVESTIGATION OF PROCESS OF ELECTRODEPOSITION OF Co−Mo ALLOYS FROM COMPLEX ELECTROLYTES. II. Influence of pH on the Composition of Deposits Obtained From Citrate Electrolytes. Bubyalis, Yu. S.; Byarnotas, A. K.; Kaushpedas, Z. P. (Inst. of Chemistry and Chemical Technology, Vilnyus, USSR). Liet. TSR Mokslu Akad. Darbai, Ser. B; 2: No. 81, 55-60(1974). (In Russian).

The current efficiency (η_K) amount of Mo in deposits, inclusions and cathodic polarization of Co−Mo alloys, obtained from citrate electrolytes as a function of electrolyte pH, have been investigated. It has been determined that increasing the electrolyte pH the η_K reaches its maximum, the amount of Mo in deposits and inclusions also begins to increase. The maximum of η_K is in lower pH with additions of acetone and isopropyl alcohol. The increase of Mo amount in deposits and inclusions begins in lower pH with the same additions. (auth)

17173 INCREASING THE HEAT RESISTANCE OF NIOBIUM ALLOYS. Petrovskaya, L. M.; Ponomarenko, E. P.; Kolomytsev, P. T.; Potapov, V. D. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 226-231(1973).

Coatings for Nb gas-turbine blades to operate at 1200°C and above were evaluated. Diffusion surface alloying was produced by vacuum metallization with Cr, Ti, and Si, either singly or in combination. Scaling resistance was determined by weight gain after holding at various temperatures ranging up to 1500°C. Among the single-component coatings, the heat resistance was highest for silicide coatings, but their low resistance to temperature changes and tendency to crack make them unsuitable. Among the multicomponent coatings, the heat resistance was highest for Ti−Cr−Si coatings. (Metals Abstr.)

17174 KINETICS OF Nb AND Nb_3Sn DEPOSITION FROM THE GASEOUS PHASE. Ugol'nikova, T. A.; Moiseev, A. I. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 199-203(1973).

Deposits of Nb and Nb_3Sn were obtained by reducing vapors of the respective chlorides with H on the surface of heated substrates (Pt or W wire). Kinetics of the deposition were investigated in relation to the substrate temperature, the composition of the vapor/gas mixture and the H flow. It was found that at a given substrate temperature the growth rate of the deposit depends greatly on the purity of the original materials and the presence of gaseous impurities. The rate of deposition decreases when the flow of chloride or H vapors to the heated surface is very slow. (Metals Abstr.)

17175 COMBINED SATURATION OF ALLOY ZhS6-K WITH ALUMINUM AND TANTALUM AND ALUMINUM AND NIOBIUM. Veksler, Yu. G.; Kupriyanov, I. L. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 170-174(1973).

The slip method was used for combined alloying of Ni−Cr alloy ZhS6-K with Al and Ta or with Al and Nb to improve its heat resistance. The slip was applied on the samples by painting or dipping. It consisted of n-xylene (solvent), polystyrene as stabilizer and Al powder, as well as Nb or Ta powder. The samples were subjected to metallographic analysis and microhardness was measured. The distribution of alloying elements through the depth of the coating and the phase compositions were determined. Heat resistance was highest for the coating produced from a mixture of 70% Ta + 30% Al and 60% Nb + 40% Al. (Metals Abstr.)

17176 PHASE AND STRUCTURAL TRANSFORMATIONS DURING CHEMICOTHERMAL TREATMENT. Kontorovich, I. E. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 36-42(1973).

Differences in the mechanism of surface hardening of Fe alloys by C (carburizing) and by N (nitriding) are discussed. Nitriding is one form of "chemicothermal ageing", which is distinguished from ordinary (thermal) ageing by the fact that it is completed when the element diffusing into the alloy forms a chemical compound with one of the components of the alloy, precipitating from the solvent during saturation. Chemicothermal ageing in other systems is illustrated by investigations of the saturation of Fe alloys with elements that have a small atomic radius−Be and B. Chromizing is another example. Microstructural phenomena characterizing this type of ageing are discussed. (Metals Abstr.)

17177 POWDER METALLURGY DEVELOPMENTS IN VEHICLE PROPULSION SYSTEMS. McIntire, H. O.; Veeck, S. J. (Battelle Columbus Labs., OH). pp 294-306 of Sixth National SAMPE Technical Conference. Vol. 6. Azusa, CA; Society for Advancement of Material and Process Engineering (1974).
From sixth national SAMPE technical conference on materials on the move; Dayton, Ohio, USA (8 Oct 1974). See CONF-741058-.
The nature of the powder metallurgy (P/M) industry is described and the areas where it has made an impact in vehicle propulsion systems are reviewed. Developments which have been important in increasing the applications of P/M, properties obtained, and examples of P/M applications are presented. Suggestions are made for further development effort. (auth)

17178 GRAIN REFINEMENT THROUGH THERMAL CYCLING IN AN Fe–Ni–Ti CRYOGENIC ALLOY. Jin, S.; Morris, J. W. Jr.; Zackay, V. F. (Lawrence Berkeley Lab., CA). Met. Trans.; 6: No. 1, 141-149(Jan 1975).
A thermal cycling technique which allows the grain refinement of Fe–12 Ni–0.25 Ti alloy from 40 ~ 60 μm (ASTM #5~6) to 0.5 ~ 2 μm (ASTM #15~18) in four cycles has been developed. The process consists of alternate annealing in γ range and $(\alpha + \gamma)$ range with intermediate air cooling. The transformation behavior, the change of microstructures and cryogenic mechanical properties on each cycling step are described. Owing to the ultrafine grain size, the ductile-brittle transition temperature of this ferritic alloy in Charpy impact testing was suppressed below 6°K. In fracture toughness testing at 77°K, the mode of fracture was altered from brittle quasi-cleavage to complete ductile rupture through the grain refining. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 16463, 17035, 17055, 17075, 17077, 17569, 18103, 18356, 18365–18367, 18371, 18375–18380, 18386, 18387, 18393, 18398, 18784, and 18786.

17179 (AD-777098) BERYLLIUM REINFORCED TITANIUM MATRIX COMPOSITE BLADE FOR TURBINE FANS AND COMPRESSORS. Final Report, 15 January 1972–15 December 1973. Sippel, G. R.; Stuerud, R. W.; Herman, M. (General Motors Corp., Indianapolis, Ind. (USA). Detroit Diesel Allison Div.). Feb 1974. Contract N00019-72-C-0247. 129p. (DDAD-EDR-8057). NTIS $4.75.
A total of thirteen Be/Ti composite TF41-A100 LP1 fan blade forgings were produced by isothermal forging two types of composite material. Both composite material preforms were initially produced by coextruding Be/Ti composite material surrounded by a sheath of titanium alloy. One type composite was a single extrusion of beryllium and Ti–6Al–6V–2Sn alloy powders, while the other was a multiple extrusion of beryllium rods in wrought Ti–6Al–4V alloy sheaths, with the final extrusion containing a Ti–6Al–4V wrought sheath around the composite bundle. Ti–6Al–4V root block split halves were contour machined to fit the elliptical composite extrusions and subsequently diffusion bonded by hot isostatic pressing. Tensile properties and metallographic structures were determined from one blade forging of each type composite material. Tensile strengths of the Be rod/Ti composite blade airfoil ranged from 90 to 91 ksi compared with 46 to 67 ksi for the Be/Ti powder composite blade. (GRA)

17180 (AD-777766) FIRST ORDER TEMPERATURE CORRECTIONS TO THE FREQUENCY MOMENTS OF THE SPECTRAL FUNCTION OF ANISOTROPIC HEISENBERG SPIN SYSTEMS. Technical Research Report. Malinoski, F. A. (Frankford Arsenal, Philadelphia, Pa. (USA)). Jun 1973. 40p. (FA-R-2083). NTIS $3.25.
The first-order temperature corrections to the zeroth and second, longitudinal and transverse, wave-vector-dependent frequency moments are calculated for a Heisenberg spin system with uniaxial and exchange anisotropy and with an arbitrary interaction range. These moments are applied to several lattices, including the hexagonal close-packed structure of terbium, which possesses a large uniaxial anisotropy constant. The calculated energy transfer of magnetically scattered neutrons is shown to be in good agreement with experimental data for terbium and also gives evidence of a significant short-range-order effect. (GRA)

17181 (AD-780085) PLANAR HIGH ENERGY PERMANENT MAGNETS. Semiannual Report, 1 October 1973–28 February 1974. Willson, M. C.; Janowiecki, R. J. (Monsanto Research Corp., Dayton, Ohio (USA)). May 1974. Contract DAAB07-73-C-0112. 50p. (ECOM-0112-2-73). NTIS $3.25.
The purpose of the program is to demonstrate the feasibility of fabricating cobalt–rare earth permanent magnets by the arc plasma spraying process. Property goals for spray-fabricated magnets consisted of a coercive force of 6000 oersteds and an energy product of 8 million gauss-oersteds. During this reporting period, magnet samples were fabricated in disk and tube shapes mostly using a spray powder of nominal composition 37.2 wt % Sm–Co. Magnetic properties of sprayed magnets were enhanced by post-spray heat treatment and aging. Conventional and novel heat treatment methods were investigated. Second and third quadrant demagnetization curves were obtained. Density, microstructure, crystallographic orientation, reproducibility and thermal stability were studied. The best magnet produced during this program displayed a coercive force of approximately 5000 oersteds and an energy product of 7.3 million gauss-oersteds. (GRA)

17182 (AD-781469) PROPERTIES OF MODIFIED NITINOL ALLOYS. Gudas, J. P.; Davis, D. A.; Gomba, F. J. (Naval Ship Research and Development Center, Annapolis, Md. (USA)). Mar 1973. 28p. (NSRDC-3919). NTIS $4.50.
Production and testing of 11 modified nitinol alloys are described. Corrosion properties, mechanical properties, processing parameters, and microstructural characteristics have been determined as the function of alloy type. Results indicate that substitutional additions of Mo, Fe, and Cr are beneficial in preventing localized crevice corrosion. Further studies are being undertaken to determine long-term corrosion behavior of alloys produced as well as to broaden the data base describing the effects of the level of alloy content. (GRA)

17183 (AD-781936) INVESTIGATION OF THE EFFECT OF CERTAIN ELEMENTS ON THE HEAT RESISTANCE OF TITANIUM ALUMINIDE Ti_3Al. Andreev, O. N.; Kornilov, I. I. 19 Mar 1974. Translated by J. McVay from pp 101-104 of Novyi Konstruktsionny Material-Titan, Moscow, 1972. (FSTC-HT-23-231-74). 7p. NTIS $4.00.
The effect of one at. % of group IV–VIII transition metals and group IV B elements on the heat resistance of Ti_3Al was investigated. From group IV, ZR and HF were selected; from group V, V, Nb, and Ta; from group VI, Cr, Mo, and W; from group VII, Mn; from group VIII, Fe, Co, and Ni; and C, Si, Ge, Sn, and Pb were selected from group IVB. (GRA)

17184 (AD-782338) GIANT MAGNETICALLY INDUCED CHANGES OF THE ELASTIC MODULI IN $Tb_{0.3}Dy_{0.7}Fe_2$. Clark, A. E.; Savage, H. T. (Naval Ordnance Lab., White Oak, Md. (USA)). 26 Apr 1974. 11p. (NOL-TR-74-75). NTIS $3.00.
Discussions are presented on increases in sound velocity of greater than 60% upon magnetization of highly magnetostrictive $Tb_xDy_{1-x}Fe_2$. Where x approximately equals 0.3. This change corresponds to a Young's modulus increase (ΔE effect) of about 160%, by far the largest known. (GRA)

17185 (AD-782908) MOBILITY OF COINCIDENCE AND NEAR COINCIDENCE GRAIN BOUNDARIES. Final Report. Higgins, G. T.; Gordon, P. (Illinois Inst. of Tech., Chicago (USA)). Jul 1974. 8p. (AROD-7996.3-MC). NTIS $3.00.
A summary is presented of the results and conclusions of a study of: (1) single boundary migration in zone refined cadmium, (2) the analysis of grain growth and single boundary migration data, and (3) the mathematical approach to the specification of coincident site relationships. The publications and oral presentations that have resulted from the work are listed. (GRA)

17186 (AD-783259) SURFACE VIBRATION MODES IN MONATOMIC BODY-CENTERED CUBIC CRYSTALS: THE (001) SURFACE. Zoth, V. (Texas Univ., Austin (USA). Dept. of Physics). Nov 1973. 184p. (AFOSR-TR-74-1256). NTIS $5.50.
Surface vibration modes for the (001) surface of monatomic bcc crystals are examined using a simple model which allows for full cubic anisotropy and which exactly fits the second-order elastic constants. For both the semi-infinite crystal and the crystal slab approaches, the effect of anisotropy is examined for iron, vanadium, and isotropic tungsten. For each crystal a surface mode with shear-horizontal polarization is found below the SH bulkband along the (100) direction but not along the (110) direction. For long wavelength, the frequency of this surface mode departs from the bulk band edge as the inverse cube of wavelength and the localization depth is proportional to the inverse square of wavelength. A surface mode with SH polarization is found above the SH bulkband in both the (100) and (110) directions for vanadium. In addition to the Rayleigh waves, a number of short wavelength surface modes with sagittal-plane polarization are found for each crystal. (GRA)

17187 (AD-783765) SELECTION OF COMPOSITION AND HEAT TREATMENT OF CAST MAGNETIC ALLOYS. Zabolotskii, A. A. 3 May 1974. Translated from pp 340-343 of Osnovy Obrazovaniya Liteinykh Splavov, Moscow. (FSTC-HT-23-2372-72). 6p. NTIS $4.00.

There are at present only two alloys – YUNDK24 and YUNDK35T5 (Co – Ti – Fe – Al – Cu – Ni – Nb) with high magnetic energy. The problem of making new alloys with magnetic properties is discussed. The composition of starting alloys, necessary heat treatment, and magnetic properties of obtained alloys are described. The effect of the content of Ni and Co, as well as of heat treatment on the magnetic properties of new alloys is also discussed. (GRA)

17188 (AD-784441) DEVELOPMENT OF ULTRAFINE-GRAIN-SIZE TITANIUM WITH IMPROVED MECHANICAL PROPERTIES. Final Report. May, R. C. (Franklin Inst. Research Labs., Philadelphia, Pa. (USA)). Jun 1974. Contract N62269-73-C-0522. 51p. (FIRL-F-C-3603). NTIS $3.75.

Tear, notched tensile, and fatigue crack propagation tests were used to assess the resistance of titanium material toughness to reduction in methanol-chloride and aqueous-chloride environments. Material variables included grain size, texture, cold work, interstitial content, and substitutional alloying. Unalloyed material, recrystallized to an ultrafine grain size, showed better resistance to degradation by the environments than Ti – 5Al – 2.5Sn and Ti – 6Al – 4V alloys. A scanning electron microscopy study of the fracture surfaces of tear specimens revealed the presence of mechanical texturing. Experiments directed toward the production of ultrafine grain size titanium by reactive hot pressing of titanium hydride powder were conducted. (GRA)

17189 (AE-499) OBSERVATIONS OF PHASES AND VOLUME CHANGES DURING PRECIPITATION OF HYDRIDE IN ZIRCONIUM ALLOYS. Oestberg, G.; Bergqvist, H.; Pettersson, K.; Attermo, R.; Norrgard, K.; Jansson, L. G.; Malen, K. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Oct 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

The effects of hydride on the properties of zirconium alloys depend, among other things, on the nature or crystallographic modification of the hydride, and the volume changes associated with its formation. Observations relating to the occurrence in various alloys of γ and δ hydrides, respectively, and the volume changes during precipitation of δ hydride are described and discussed with reference to earlier work in this field. (auth)

17190 (AED-CONF-74-261-001) ELECTRON WORK FUNCTIONS OF STEPPED TUNGSTEN SURFACES. Krahl-Urban, B.; Wagner, H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Grenzflaechenforschung und Vakuumphysik). 1974. 7p. (In German). INIS.

From DECHEMA annual meeting; Frankfurt am Main, Germany (4 Jun 1974).

For three highly indexed tungsten samples near the (110) surface with almost the same step density but of different edge structure, considerably different lowerings of the work function compared with the (110) surface were measured. These changes of work function could be explained quantitatively in a model based on empirical mathematical interrelationships for electron negativity. (GE)

17191 (AED-CONF – 74-261-002) LOWERING OF WORK FUNCTIONS IN THE ADSORPTION OF STEPPED TUNGSTEN SURFACES. Besocke, K.; Wagner, H. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Inst. fuer Grenzflaechenforschung und Vakuumphysik). 1974. 9p. (In German). INIS.

From DECHEMA annual meeting; Frankfurt am Main, Germany (4 Jun 1974).

On stepped tungsten surfaces formed by (110) terraces with two different terrace widths, the dependence of the depression of the work function upon the degree of covering for various substrate temperatures and two terrace widths was measured. The interpretation concerning the assignment of a dipole moment to adatoms and edge atoms is confirmed. (GE)

17192 (AED-CONF-74-261-003) LEED STUDIES AT STEPPED W SURFACES. Besocke, K.; Wagner, H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Grenzflaechenforschung und Vakuumphysik). 1974. 6p. (In German). INIS.

From DECHEMA annual meeting; Frankfurt am Main, Germany (4 Jun 1974).

LEED studies have been performed on stepped tungsten surfaces. The stepped surfaces of W formed by special preparation are thermally stable, their dimensions can be determined (terrace width and height), the orientation of the surfaces can be determined precisely by LEED. (GE)

17193 (AGARD-CP-155) SPECIALISTS MEETING ON LOW CYCLE HIGH TEMPERATURE FATIGUE. Papers Presented at the 38th Meeting of the Structures and Materials Panel in Washington, D. C., 21 – 26 April 1974. (Advisory Group for Aerospace Research and Development, 92 – Neuilly-sur-Seine (France)). Aug 1974. vp. (CONF-740479-).

Seven papers were presented at the meeting. A separate abstract was prepared for each of two papers selected by NSA scope. Papers for which no abstracts were prepared are concerned with fatigue in jet engine components, low cycle fatigue, multiaxial fatigue, and design of components subject to fatigue. (JRD)

For abstracts of individual papers see: 17194 and 17195.

17194 (AGARD-CP-155, pp 2.1-2.47) OVERVIEW OF HIGH TEMPERATURE METAL FATIGUE; ASPECTS COVERED BY THE 1973 INTERNATIONAL CONFERENCE ON CREEP AND FATIGUE. Manson, S. S. (Case Western Reserve Univ., Cleveland, OH); Halford, G. R. Aug 1974.

From specialist meeting on low cycle high temperature fatigue; Washington, District of Columbia, USA (21 Apr 1974).

In specialists meeting on low cycle high temperature fatigue.

A review of papers presented at the 1973 conference is given under the subjects of materials development and charaeristics, environmental factors, general fatigue life relations, crack growth laws, design code activities, and design and service activities. (JRD)

17195 (AGARD-CP-155, pp 6.1-6.18) LIFETIME PREDICTION METHODS FOR ELEVATED TEMPERATURE FATIGUE. McEvily, A. J.; Crosby, S. R. (Univ. of Connecticut, Storrs). Aug 1974.

From specialist meeting on low cycle high temperature fatigue; Washington, District of Columbia, USA (21 Apr 1974).

In specialists meeting on low cycle high temperature fatigue.

Recently developed methods for lifetime prediction at elevated temperatures are reviewed. These methods can be categorized as either (a) parametric, (b) damage summation, (c) strainrange partitioning, or (d) frequency modification. The capabilities and limitations of these various approaches are discussed and the problem of extrapolation beyond laboratory experience is considered. (auth)

17196 (BARC-768, pp 182-185) SHORT SAMPLE TESTS ON HIGH FIELD SUPERCONDUCTING MAGNET MATERIALS. Radhakrishnan, T. S.; Hariharan, Y.; Bose, D. K.; Gupta, C. K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

17197 (BNL-19271) EFFECT OF METALLURGICAL HISTORY ON 'J_c(5T)' IN SURFACE DIFFUSED MULTIFILAMENTARY Nb_3Sn. McInturff, A. D.; Larbalestier, D. C. (Brookhaven National Lab., Upton, N. Y. (USA); Science Research Council, Chilton (UK). Rutherford Lab.). 30 Sep 1974. 12p. (CONF-740957-23). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

Data are presented of critical current density 'J_c(5T)' at a 5 T perpendicular magnetic field (10 T for selected samples) for multifilamentary Nb_3Sn formed by Sn diffusion from a Cu – Nb composite's outer surface. The parameters varied are: composite diameter and ratio; Sn percentage; filament diameter; reaction temperature and time; and different combinations of the above sequences. The composite diameter varied from 0.254 to 0.08 mm; Cu/Nb volume ratio from 1.7 to 3; Sn volume from 2 to 13.8% of the total volume; average filament diameter from 2 to 7 microns. The reaction temperature was between 550 to 795°C for varying lengths of time, one to several thousand hours. A three-stage heat treatment was selected to formulate the basis for the reaction heat treatment map. The J_c(5T) varied from 10^3 to $> 3 \times 10^5$ A/cm^2 over the entire composite cross section (Cu – Sn, Nb_3Sn, Nb). The optimum performances were 38.8 A in 0.127 mm dia 1.9 Cu/1 Nb (Nb_3Sn) composite at 5 T and 78 A in a 0.18 mm dia 3/1 Cu/Nb (Nb_3Sn) at 5 T. (auth)

17198 (BNL-19276) EFFECT OF SURFACE METALLURGY ON THE PENETRATION DEPTH AND RF BREAKDOWN FIELD OF SUPERCONDUCTING NIOBIUM. Varmazis, C.; Luhman, T. S.; Joshi, A.; Kammerer, O. F.; Giordano, S.; Strongin, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 4p. (CONF-740957-22). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

The surface metallurgy of niobium is discussed including factors such as impurity distributions at the surface and surface topography. Measurements of the penetration depth are presented both in the clean limit, where there is about a 20Å region of oxygen at the surface, after high temperature heat treatment, which affects the boundary condition on the GL order parameter; and in the dirty limit where heating in an oxygen atmosphere near 10^{-6} torr can greatly affect the surface roughness. Auger measurements of the surface conditions in a 1% Zr in Nb alloy are also presented. A discussion is given of preliminary results in a special apparatus where rf breakdown experiments can be performed on small samples and correlated with the metallurgical factors mentioned. (auth)

17199 (CEA-R-4616) CONTRIBUTION TO THE MECHANICAL STUDY OF THE BEHAVIOR OF A WELDED Z3 CN 18 TO 10 STEEL IN SERVICE. Dubois, D. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Oct 1974. 106p. (In French). Dep. NTIS (US Sales Only) $8.50.

A laminated Z3 CN 18–10 stainless steel welded by the electron beam (E. B.) or T. I. G. process is concerned. Tensile tests confirm the notch insensitivity of the material and show that the immediate mechanical behavior of the welded joint is comparable with that of the original material. It is found that as the cross section of the specimens decreases, the ultimate tensile strength increases, these variations being partly due to texture differences in the thickness. Tests to estimate the mechanical stability of the welded joints with time and the behavior of this stainless steel in service show that it is deformed under constant stress at room temperature. The deformation is less serious on the welded samples than on the basic material. Fatigue resistance is greater than the standard yield strength and varies according to the direction of sampling, increasing for specimens cut transversely. It is not affected by E. B. welding and increases only with arc welding as the result of an improvement of yield strength. (auth)

17200 (COM-74-11359) STANDARD REFERENCE MATERIALS: ANALYSIS OF INTERLABORATORY MEASUREMENTS ON THE VAPOR PRESSURES OF CADMIUM AND SILVER (CERTIFICATION OF STANDARD REFERENCE MATERIALS 746 AND 748). Special Pub. (final). Paule, R. C.; Mandel, J. (National Bureau of Standards, Washington, D. C. (USA)). Jan 1971. 32p. (NBS-SP-260-21). NTIS $4.75.

Standard reference materials 746 (cadmium) and 748 (silver) used for the measurements have been certified over a range of pressures and temperatures. The heats of sublimation at 298°K and the associated two standard error limits for cadmium and silver are 26660 plus or minus 150 cal/mol and 680.0 plus or minus 300 cal/mol, respectively. Estimates of uncertainty have been calculated for the certified temperature pressure values as well as for the uncertainties expected from a typical single laboratory's measurements. The statistical analysis has also been made for both the second and third law methods, as functions of both the heat of sublimation and the temperature. (GRA)

17201 (CONF-740957-21) CRITICAL CURRENT DENSITY IN SUPERCONDUCTING NIOBIUM FILMS. Huebener, R. P.; Kampwirth, R. T.; Martin, R. L.; Barbee, T. W. Jr.; Zubeck, R. B. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-eng-38. 4p. Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

The critical current at 4.2°K was measured in Nb-strips of 1 μm thickness and different width, w, prepared by electron-beam vacuum-deposition. The substrate temperature during the deposition was varied between room temperature and 800°C. The width of the Nb strips ranged between 20 and 300 μm. Whereas up to 600°C the different substrate temperatures yielded about the same average critical current density, J_c, (critical current divided by sample cross section) the specimens prepared with 800°C substrate temperature showed a reduction of J_c by a factor of 4 to 8. In zero applied magnetic field the samples prepared with 400°C substrate temperature or lower showed a decrease of J_c roughly proportional to $w^{-1/2}$. Critical current data obtained in an applied perpendicular field, for the high-field regime, were compared with Kramer's theory of flux pinning which assumes plastic shearing of the flux-line lattice around individual pinning sites during flux flow. (auth)

17202 (CONF-741057-3) HIGH-FIELD SUSCEPTIBILITY IN FERROMAGNETIC $NpOs_2$. Dunlap, B. D.; Aldred, A. T.; Lam, D. J.; Davidson, G. R. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-eng-38. 7p. Dep. NTIS $4.00.

From international symposium on the electronic structure of the actinides; Argonne, Illinois, USA (9 Oct 1974).

$NpOs_2$ is known to be a ferromagnet with a Curie temperature of 7.5°K. Results of bulk magnetization measurements indicated a field induced magnetization even well below the transition temperature. This was extended by a measurement of the local high-field susceptibility, using the Mössbauer effect in ^{237}Np. At 1.6°K, a susceptibility of $(1.2 \pm 0.2) \times 10^{-2}$ emu/mole is obtained, in general agreement with the bulk measurement. Such a large susceptibility is best understood by a model of itinerant magnetism, although other properties of the material indicate localized behavior. (auth)

17203 (CONF-741202-13) NEUTRON SCATTERING AND MAGNETIZATION MEASUREMENTS ON THE KONDO COMPOUND $CeAl_3$. Edelstein, A. S.; Brun, T. O.; Lander, G. H.; McMasters, O. D.; Gschneidner, K. A. Jr. (Argonne National Lab., Ill. (USA)). 1974. 17p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Previous measurements on the Kondo compound, $CeAl_3$ (hexagonal DO_{19}), indicate that with decreasing temperature it transforms gradually into a singlet state and does not magnetically order above 0.6°K. To determine the spatial extent of the magnetic moment the spin-dependent cross section of neutrons diffracted from the (201) planes of a polycrystalline sample in 50 kOe at 5, 19, and 81°K was measured. At 50 kOe and these temperatures the total moment from magnetization measurements on the same sample is only 5 to 15% lower than the moment determined by the neutrons if one assumes a 4f form factor. This approximate agreement supports the hypothesis that the moment decreases without changing its spatial distribution. A similar spatially uniform reduction of the moment occurs also in dilute Kondo systems. From the field dependence of the magnetization M, the characteristic or Kondo temperature is estimated to be 13°K. (auth)

17204 (ERDA-tr-2) EFFECT OF STRESS-RELIEVING ON THE MECHANICAL PROPERTIES AND THE STRUCTURE OF WELDING-SIMULATION HEAT-TREATED SPECIMENS OF HIGH-TEMPERATURE FINE-GRAINED STRUCTURAL STEELS. Detert, K.; Banga, R.; Bertram, W. Translated from Arch. Eisenhuettenw.; 45: No. 4, 245-255(1974). 23p. Dep. NTIS $4.25.

The properties of the coarse-grained structure in the heat-affected zone beside a welded joint on simulated heat-treated specimens of six fine-grained structural steels 17 MnMoV 64, 17 MnNiMoV 54, 17 MnNiMoNb 66, 22 NiMoCr 37, 17 MnNiMo 54, and 17 NiCrMo 106 were studied. Effects of stress-relieving predominantly at 580°C last up to 100h as measured by hardness and notch toughness. Data on the transition temperature for notch toughness, fracture toughness, and crack propagation rate are given. Creep rupture test results at up to 100h predominantly at 580°C on plain and notched specimens as well as stress-relieving tests on plain specimens are given. Relations between creep rupture notch sensitivity, creep rupture elongation, relaxation behavior, and stress relief cracking are described. Definition of the conditions for the development of cracks during stress relief heat treatment is made. (auth)

17205 (FEI-461) INVESTIGATION OF THE STRUCTURE OF CRYSTAL LATTICE DEFECTS OF THE W–Re ALLOYS BY THE NGR. Bykov, V. N.; Budagovskii, S. S.; Gavrilyuk, M. I.; Ivanyushkin, E. M.; Pod'yachev, V. N.; Rudnev, I. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko- Ehnergeticheskij Inst.). 1973. 20p. (In Russian). INIS.

In a study of alloys of the W–Re system, the possibility of using the nuclear γ resonance method on impurity nuclei for selective study of the construction of defects in the crystalline lattice was examined and developed. It was shown that in W–Re solid solutions the nucleus of new phases can occur on defects of the crystalline lattice (dislocations, subboundaries, and grain boundaries). These probably have a great effect on the physical and mechanical properties of the alloys. (tr-auth)

17206 (IFA-SR-9-1974) COMPUTING PROGRAMME FOR A TWO SUBLATTICE NEEL FERRIMAGNET, APPLICATION TO THE RARE-EARTH COMPOUNDS. Lazar, D. P.; Burzo, E. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

Two Fortran programs used for establishing the validity of the Neel model of the ferrimagnetic metallic systems are described. Results obtained using these programs in calculations on ferrimagnetic rare-earth systems are included. (JRD)

17207 (INIS-mf-1362) MOESSBAUER EFFECT AND SUPERCONDUCTIVITY IN GRANULAR TIN. Akserod-Kohn, S. (Tel Aviv Univ. (Israel). Dept. of Physics). Apr 1974. 75p. INIS. Thesis.

By means of recoilless resonant absorption in ^{119}Sn, a possible modification in the atomic mean square displacement $\langle x^2 \rangle$ in a small grain with high surface to volume ratio has been investigated. Granular Sn was obtained by evaporating metallic Sn on a cold Al foil (T ~ 85°K) at a rate 30 Å/s in the presence of oxygen at a pressure of 10^{-4} torr. Electron microscopy showed that these conditions stabilize metallic tin grains in the size range 30 to 50 Å. The diffraction pattern indicated that the lattice parameters of granular Sn remained within 0.01 Å identical with bulk tin. Superconductivity measurements in these samples have shown an increase in the critical temperature T_c of Sn from 3.72 to 4.1°K. Mössbauer measurements with granular absorbers were performed in the temperature range 4.2 to 300°K. The spectra were complex and showed a composition of SnO_2, red SnO and β Sn. The effective Debye temperature and the average value $\langle\omega^{-2}\rangle$ of the phonon spectrum have been obtained from the temperature dependence of the recoilless fraction. By averaging the results of measurements in three samples the following conclusions were obtained: an increase of 8% in $\langle\omega^{-2}\rangle_C$ as compared with bulk Sn and a decrease in the Debye temperature from 135°K for bulk Sn to 130°K in small grains. Results of calculations show that $\langle\omega^{-2}\rangle$ or $\langle x^2\rangle$ for the surface layer of atoms increase by about 35%. Using the theory of MacMillan a good agreement is obtained between the change in $\langle\omega^{-2}\rangle$ and the enhancement of T_c. (auth)

17208 (INR-1447/18/PP/B) THERMAL PROPERTIES OF THE MULTILAYER COATINGS PERFORMED BY PLASMA SPRAYING TECHNIQUE ON THE METALLIC MHD CHANNEL ELEMENTS. Celinski, Z.; Plata, M. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 25p. (In Polish). INIS.

The thermal properties of the ceramic multilayer coatings were tested. They were produced by plasma spraying technique on the metallic elements of the MHD generator channel. The tests were conducted in the small experimental stand where the operation conditions existing in the MHD channel were simulated. The Al_2O_3 coatings 0.5 to 4 mm thick deposited on copper elements were used. (INIS)

17209 (JINR-P4-8032) LOW TEMPERATURE MAGNETIZATION FOR HEISENBERG FERROMAGNET. Plakida, N. M.; Rusek, P. R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 11p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Low temperature magnetization for the Heisenberg ferromagnet with spin $\frac{1}{2}$ is obtained by the method of the irreducible Green function, which has no unphysical T^3 term in accordance with Dyson expansion. (auth)

17210 (JUL-1090-FF) STRUCTURE DETERMINATION OF INTERSTITIAL ATOMS IN Al USING DIFFUSE X-RAY SCATTERING IN THE INTERMEDIATE REFLEX REGION. Haubold, H. G. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Jul 1974. 94p. (In German). Dep. NTIS (US Sales Only) $7.75.

Thesis. Submitted to Technische Hochschule, Aachen (West Germany).

For interstitials the scattering cross section between the Bragg reflections is very sensitive to the position of the defect atom and the displacements of the neighboring lattice atoms. In contrast to this, the scattering near the Bragg reflections (Huang-scattering) is mainly governed by the displacement field at large distances from the defect and gives information about defect symmetry and strength. For determining structures of point defects, a measurement of scattering far from reciprocal lattice points is therefore the best suited and most direct method. This is demonstrated by numerical cross section calculations for some possible interstitial configurations which are based on Kanzaki-force defect models in a lattice statics approach. X-ray measurements of point defect scattering in this region far from reciprocal lattice points have not been done before. With conventional x-ray set-ups it was not possible to separate the defect scattering from the thermal diffuse and Compton background scattering which is up to 2 orders in magnitude larger in case of typical defect concentrations of some 10^{-4}. Such measurements, however, become possible if large samples and x-ray sources of high luminous density are used in connection with multidetector arrangements. Therefore a special experimental arrangement was developed which consists of a 100 kW x-ray tube with rotating anode, a focusing mirror, and a multidetector system, consisting of 100 Si(Li)-detectors. With this set-up the configuration of intrinsic interstitials in irradiated aluminum was determined as the 100-split configuration. The measurement was done in samples which contained an atomic density of Frenkel defects up to 5×10^{-4}. (auth)

17211 (KFK-2049) QUANTITATIVE PHASE ANALYSIS IN THE U, Pu-C-SYSTEM BY X-RAY DIFFRACTION. Ganguly, C.; Vollath, D. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Sep 1974. 38p. Dep. NTIS (US Sales Only) $5.00.

An absolute method is proposed in the following investigation for the quantitative phase analysis of mono-, di-, and sesquicarbide and dioxide in the U-Pu-C-O system by x-ray diffraction. Theoretically, the integrated intensity for the different selected lattice planes of these phases are calculated taking into consideration the crystal structure, Lorentz Polarization Factor, multiplicity factor, temperature factor, absorption factor, and unit cell volume. For the pure phase, the intensity ratios between different planes were found comparable with the corresponding measured integrated intensity ratios, thus confirming the basis of calculation. Using these calculated values and experimentally determining the corresponding integrated intensities of the x-ray diffraction pattern any unknown carbide pellet of U, Pu or U-Pu can be quantitatively analyzed directly for mono-, di-, sesquicarbide and oxide phases. (auth)

17212 (LBL-3174) STRAIN ENERGY OF A DISK-SHAPED GP ZONE. Wert, J. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1974. Contract W-7405-eng-48. 36p. Dep. NTIS $5.00.

A simplified form of Khachaturyan's solution to the general problem of determining the strain energy of an arbitrarily shaped coherent inclusion is found for the case of a disk-shaped inclusion. Specific strain energies are calculated as a function of the orientation of such an inclusion in lattices possessing various elastic properties. Some numerical results are presented. The salient features of the specific strain energy surface are found to depend only on the elastic properties of the lattice. From this a relationship between an elastic anisotropy parameter, A, and the minimum strain energy orientation of a disk-shaped inclusion is observed. The strain energies of GP zones in Al-Cu and Cu-Be age hardening alloys are calculated. The minimum strain energy orientations of GP zones in these alloys are identical with experimentally observed orientations. (11 fig) (auth)

17213 (ORNL-5103) MECHANICAL PROPERTIES TEST DATA FOR STRUCTURAL MATERIALS. Quarterly Progress Report for Period Ending October 31, 1974. Hill, M. R. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 391p. AT.

Test data on heat resisting alloy structural materials are presented. These data were obtained in research conducted at Aerojet Nuclear Company, Argonne National Laboratory, Hanford Engineering Development Company, Naval Research Laboratory, Oak Ridge National Laboratory, Westinghouse Advanced Reactors Division, University of Cincinnati, and University of California, Los Angeles. (JRD)

17214 (ORNL-TM-4709) TENSILE AND CREEP PROPERTIES OF SEVERAL HEATS OF TYPE 304 STAINLESS STEEL. McCoy, H. E. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 48p. AT.

The tensile and creep properties of 20 heats of type 304 stainless steel have been evaluated. All except one heat satisfied ASTM mechanical property requirements in the as-received condition. After reannealing, many of the heats failed to meet the requirement of a minimum room-temperature yield stress of 30,000 psi. All but one heat satisfied the minimum yield stress requirements of Code Case 1331-8 in the as-received condition, but many heats failed to satisfy this criterion after reannealing. All heats exceeded the stress-rupture requirements of Code Case 1331-8. However, the rupture times of the various heats varied by at least a factor of 10, and the minimum creep rates varied by more than a factor of 100. Long-term creep tests at 593°C show several basic types of creep curves. (auth)

17215 (ORNL-tr-2851) DETECTION AND ESTIMATION OF MISFIT ENERGIES IN LIQUID AND SOLID ALLOYS. Predel, B. Translated by R. G. Mansfield from Acta Met.; 14: 209-219(1966). 16p. Dep. NTIS $4.00.

A relation is shown between the mixing enthalpies and the mixing entropies of binary melts on one hand and the difference of atomic volumes on the other hand. This relation permits an approximate partition of the state functions, namely into a term due to chemical binding and a term due to the misfit caused by substitution of a matrix atom by an atom of different size. While the misfit fraction of the mixing enthalpy may be rather large, the amounts of enthalpies due to chemical interactions are relatively small for all decomposition systems. They may be not only positive, but also negative in sign. The deviations from an irregular atomic distribution are consequently small. The positive excess entropies for decomposition systems are largely due to the misfit. The same conclusions hold for liquid and solid alloys. (auth)

17216 (ORO-3665-44) STUDY OF VERY PURE METALS AT LOW TEMPERATURE. Progress Report. (Georgetown Univ., Washington, D. C. (USA). Dept. of Physics). Sep 1974. Contract AT(40-1)-3665. 82p. Dep. NTIS $7.25.

Research progress is reported on nonequilibrium superconductors, superconducting transitions near 14°K, continuous warming specific heat measuring methods, ac susceptibility methods, tunnel junction studies, and high transition temperature materials. (JRD)

17217 (PEL-230) THERMODYNAMIC PROPERTIES AND PHASE DIAGRAM OF TERNARY SODIUM ALLOYS. I. The System Sodium + Cadmium + Indium. Neethling, A. J. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Apr 1974. 21p. Dep. NTIS (US Sales Only) $4.25.

Electromotive force measurements in the temperature range 670 to 760°K have been used to determine the thermodynamic properties of the sodium component of the ternary sodium + cadmium + indium system. Darken's method was used to calculate the corresponding properties for the cadmium and indium components. The solid-liquid equilibrium surface for the system was also determined using thermal analysis. The maximum equilibrium temperature recorded was 745°K. (auth)

17218 (RDT-M-2-2T(12-74)) STAINLESS AND LOW ALLOY STEEL FORGINGS (ASME SA-182 WITH ADDITIONAL REQUIREMENTS). (USAEC Division of Reactor Research and Development, Washington, D.C.). Dec 1974. 11p. RSO.

A standard prescribing requirements for stainless and low alloy steel forgings (ASME SA-182 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDTM 2-2T, dated October 1973. (JRD)

17219 (RDT-M-2-5T(1-75)) AUSTENITIC STAINLESS STEEL WELDING FITTINGS (ASME SA-403 WITH ADDITIONAL REQUIREMENTS). (USAEC Division of Reactor Research and Development, Washington, D. C.). Jan 1975. RSO.

A standard prescribing requirements for austenitic steel welding fittings CASME SA-403 with additional requirements for nuclear and associated applications is presented. This standard supersedes RDT M 2-5T dated May 1973. (JRD)

17220 (RDT-M-3-12T(1-75)) SEAMLESS FERRITIC ALLOY STEEL PIPE (ASME SA-335 WITH ADDITIONAL REQUIREMENTS). (USAEC Division of Reactor Research and Development, Washington, D. C.). Dec 1974. 7p. Dep. NTIS RSO Free.

A standard prescribing requirements for seamless ferritic alloy steel pipe (ASME SA-335 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 3-12T, dated July, 1971. (JRD)

17221 (RISO-312) EXCITATIONS AND MAGNETIC PROPERTIES OF RARE-EARTH Al_2 COMPOUNDS. Bak, P. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jul 1974. 64p. Dep. NTIS (US Sales Only) $6.25.

Thesis.

Magnetic excitation spectra, measured by inelastic neutron scattering, and single-crystal magnetization curves of rare-earth Al_2 compounds are analyzed using a Hamiltonian including 4th and 6th order crystal field terms and an isotropic exchange interaction between the magnetic ions. The magnetic excitations—"excitons"—are transitions between single-ion atomic levels propagating through the lattice via the exchange interaction. In $NdAl_2$ dispersion relations of excited mean-field states are described. A double peak structure in the neutron spectrum of $TbAl_2$ is interpreted as a new effect: the magnon-exciton interaction. To calculate the excitation energies a Green's function theory was evaluated. A detailed microscopic description of the magnetic anisotropy of $NdAl_2$, $PrAl_2$, $TbAl_2$, and $ErAl_2$ is given in terms of two-temperature and field-independent crystal field parameters by means of a two-dimensional mean-field theory. The crystal field parameters are shown to behave systematically throughout the entire rare earth Al_2 series, indicating that the effective charge distribution around the magnetic ions is independent of the particular rare earth constituent. (auth)

17222 (RN-DR-0093) PROPOSED FRACTURE TOUCHNESS EVALUATION FOR NERVA PRESSURE VESSEL ALLOYS. Crimmins, P. P.; Gerberich, W. W.; Hartbower, C. E. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1967. 55p. Dep. NTIS $5.75.

A test program is presented for evaluating the Alloy 718 for fabricating the NERVA pressure vessel. Although this analysis does not provide for irradiation tests, such studies should be conducted if the Alloy 718 is found satisfactory on the basis of the results obtained through this program. The proposed tests will provide extensive base line data for both parent metal and weldments which can be employed in determining the effects of irradiation on the fracture toughness of the Alloy 718. (9 tables, 13 figures) (DLC)

17223 (RN-S-0311) NERVA MATERIALS DEVELOPMENTS. 2nd Quarter, Contract Year 1966, 1 January–31 March 1966. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1966. 77p. Dep. NTIS $7.00.

Activities of the NERVA Program in the field of materials and processes during the Second Quarter of SNP-1 Contract Year 1966 are discussed. Topics include materials investigations related to nozzles, turbopumps, bearings, valves, pressure vessels, facilities, radiation effects, design, cost reduction, technical utilization, and data reporting. (auth)

17224 (RN-S-0312) NERVA MATERIALS DEVELOPMENT. Third Quarter, Contract Year 1966 (1 April–31 July). (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1966. 114p. Dep. NTIS $8.75.

Activities of the NERVA Program in the field of materials and processes during the third quarter of SNP-1 Contract Year 1966 are discussed. Topics include materials investigations related to nozzles, turbopumps, bearings, valves, pressure vessels, facilities, radiation effects, design, cost reduction, technical utilization, and data reporting. (auth)

17225 (RN-S-0424A) UNCERTAINTY ANALYSES FOR RADIATION EFFECTS TESTS. Sanders, R. H.; Thomas, E. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1967. 50p. Dep. NTIS $5.50.

The uncertainty involved in thermal conductivity experiments associated with radiation testing of materials is evaluated. It is concluded that experimental accuracy for aluminum and beryllium specimens is very good, with a maximum heat leak of approximately 2% of specimen heater power. The leakage for graphite is good up to room temperature with a maximum leakage of about 5% of specimen heater power. This is based on the assumption that the shield and backing are not in contact. Results for titanium specimens show the poorest accuracy with maximum leakage in excess of 10% of specimen heater power. A supplementary reference bath of Freon 114 could be used to improve experimental accuracy at temperatures above room temperature to about 700°K. However, the large temperature drop across the boiling Freon 114 film causes a large bias in thermocouple reference temperature. This suggests the need for direct temperature measurement at the reference ring. Temperature measurement error at thermocouples TC_1, TC_2, and TC_3 is negligible because of the predominance of thermocouple wire thermal resistance between the junction and the shield. (auth)

17226 (RN-S-0461) PLANE STRAIN FRACTURE TOUGHNESS, AND FATIGUE TESTS OF A LARGE Ti-5 Al-2,5 SN ELI (GRADE) FORGING IN LIQUID HYDROGEN. Dessau, P. P.; Crimmins, P. P. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1968. 41p. Dep. NTIS $5.25.

A series of tests was carried out on a large titanium forging to determine the suitability of the material for use in rotating machinery at cryogenic operating temperatures. The radial and tangential tensile properties of the forging were found to be satisfactory on the basis of −423°F notched (K_T 5–6) to unnotched tensile strength ratios in excess of 1.00 and tensile elongations in excess of 8%. Part-through-precracked tensile fracture toughness testing at −423°F resulted in K_{Ic} values in excess of 71 ksi–in$^{1/2}$. Axial fatigue testing in liquid hydrogen at −423°F produced close to expected results at the low load ratio (A) but less than the expected results at higher load ratios. This condition was attributed to the adverse effect of coarse grain size. (15 fig, 7 tables) (auth)

17227 (SAND-74-5488) INFLUENCE OF THE ELECTRONIC STRUCTURE ON THE Ti–V–H PHASE DIAGRAM. Switendick, A. C. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 7p. (CONF-741064-1). Dep. NTIS $4.00.

From 8th US/UK neutron generator symposium; Albuquerque, New Mexico, USA (21 Oct 1974).

Calculations have been performed for cubic TiH_2 and VH_2 and the tetragonally distorted TiH_2 in an attempt to explain the phase diagram of the Ti–V–H system. Results of the calculations demonstrate that the distortion is caused by the existence of degenerate states at the Fermi level whose degeneracy is lifted by the tetragonal distortion–an example of the Jahn-Teller effect in a metal. The effect of varying vanadium concentration and varying hydrogen concentration on the position of the phase boundaries is discussed in terms of the calculational results. (auth)

17228 (WANL-TME-1956) MATERIAL SELECTION FOR SUPPORT PLATE: Al 2219-T852 vs. Al 6061-T652. McAndrew, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1969. 27p. Dep. NTIS $4.50.

The significant differences between 6061–T652 and 2219–T852 for the support plate application are in mechanical properties. Comparisons show that at elevated temperature the 2219 is much stronger and less subject to degradation of strength. The margin is from 25 to 200% increase over 6061 strength, depending on the particular temperature and time. The strength advantage of 2219 offers the possibility of increasing the temperature of the component from 100 to 200°F depending on the exposure time and on which strength parameter is limiting in the design. At cryogenic temperatures, the strength advantage of 2219 is 30 to 40%. The lower strength of 6061 is accompanied by higher ductility; however the ductility and toughness of 2219 are adequate, so that no benefit is gained from the excess ductility in 6061. The radiation resistance of 6061 forgings cannot be properly assessed because the data required are not available. However, the radiation resistance of 2219 forgings has been shown to be adequate, so that even if 6061 should prove better in this respect, the greater resistance to damage would not be useful. (13 tables) (auth)

17229 IMPURITY EFFECT ON THE ANISOTROPY OF THE UPPER CRITICAL FIELD OF Nb–Ta ALLOYS. Ohta, N.; Yamamoto, M.; Ohtsuka, T. (Tohoku Univ., Sendai). pp 82-85 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The effects of additions of Ta on the upper critical field of Nb–Ta alloys were investigated. Results are presented in graphs showing the temperature dependence of critical field anisotropy as related to Ta additions. (JRD)

17230 EFFECTS OF SURFACE SUPERCONDUCTIVITY IN LOW-KAPPA Al–Ag ALLOYS. Nemoz, A.; Solecki, J. C. (CNRS, Grenoble, France). pp 95-101 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The evolution of superconductive properties of Al–4.15 and 5.02 at. % Ag alloys during isothermal aging was studied using magnetization measurements. It was found that magnetization irreversibility vanishes as the magnetization of the superconductive sheath decreases. The effects of surface currents on magnetization irreversibility in these alloys are analyzed. (JRD)

17231 SPECIFIC HEAT OF VERY PURE NIOBIUM IN THE MEISSNER AND MIXED STATES. Gough, C. E. (Univ. of Birmingham, Eng.). pp 112-115 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of the specific heat of niobium were made in the superconducting Meissner and mixed states for three samples of niobium of widely different purity in the temperature range 0.3°K to T_c. (MHR)

17232 TEMPERATURE DEPENDENCE OF ULTRASONIC ATTENUATION IN THE MIXED STATE OF PURE NIOBIUM. Carsey, F. (NOAA/ERL Wave Propagation Lab., Boulder, CO); Levy, M. pp 116-119 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements were made on high-purity Nb. Data on 45-MHz longitudinal wave attenuation as function of temperature are presented and discussed along with data on attenuation of longitudinal waves in the BCS and gapless regimes. (JRD)

17233 MIXED-STATE ULTRASONIC ATTENUATION IN CLEAN NIOBIUM. Purvis, M. K.; Johnson, R. A.; Hoffman, A. R. (Univ. of Massachusetts, Amherst). pp 120-124 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements of ultrasonic attenuation in Nb as function of magnetic field are presented and discussed. Variations in normalized ultrasonic attenuation in Nb at 4.2 and 1.4°K near the upper critical field are shown in graphs. (JRD)

17234 ATTENUATION OF SOUND $ql > 1$, IN NIOBIUM AT LOW FLUX DENSITIES. Jump, R. E.; Gough, C. E. (Univ. of Birmingham, Eng.). pp 125-129 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of longitudinal and transverse sound wave attenuation in Nb are reported. Data on ultrasonic attenuation as function of temperature and trapped flux are presented and discussed along with graphs showing frequency dependence of the attenuation arising from bound excitations. (JRD)

17235 THERMAL CONDUCTION IN THE MIXED STATE OF SUPERCONDUCTING NIOBIUM AT LOW TEMPERATURES. Muirhead, C. M.; Vinen, W. F. (Univ. of Birmingham, Eng.). pp 130-133 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The flow of heat in the low-field mixed state of two Nb single crystals was studied. It was found that there is a strong possibility that the electronic excitations in the cores of flux lines in pure Nb are affected by flux line interactions. It is noted that a rigorous theory of the effect of core excitations on transport properties when there is impurity scattering is needed. (JRD)

17236 ENTROPY OF A TYPE II SUPERCONDUCTOR IN THE MIXED STATE CLOSE TO T_c. Ehrat, R.; Rinderer, L. (Univ., Lausanne, Switzerland). pp 134-137 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

An analysis is presented of the thermodynamic relation showing that an anomaly in the superconductor specific heat at constant field should be correlated with anomalies of either specific heat at constant induction, the incremental entropy, or the three coordinates at equilibrium. (JRD)

17237 FLUX PINNING IN TYPE II SUPERCONDUCTORS. de Klerk, D.; Kes, P. H.; van der Klein, C. A. M. (Kamerlingh Onnes Laboratorium, Leiden). pp 138-142 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Experiments were carried out on the effect of flux pinning in type-II superconductors. Several pinning mechanisms were investigated: surface pinning, bulk pinning due to grain boundaries, dislocations (caused by cold-working), and clusters of point defects (caused by neutron irradiation). The quantities determined in the experiments were the dc magnetization (or average flux density), the ac permeability components, and the heat conductivity. Experiments were performed on a niobium sample with a grain size of 35 μm. It turned out that between H_{c1} and H_{c2} the values of the magnetization computed from the author's formulas are in good agreement with their experimental results in the region where the reversible curve is in agreement with experimental data, that is for $T/T_c > 0.5$). (MHR)

17238 MAGNETIC MOMENT IN METALS EXCITED BY HEAT FLOW. Zavaritskii, N. V. (Inst. for Physical Problems, Moscow). pp 143-146 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of an experimental study on the magnetic field excited in metals by heat flow are presented. It was found that in metals with torsional deformation of the crystal lattice, heat flow can excite a magnetic field. (JRD)

17239 TRANSITION TO THE MIXED STATE IN LEAD FILMS AT 4.2°K. Dolan, G. J.; Silcox, J. (Cornell Univ., Ithaca, NY). pp 147-151 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Observations of microscopic magnetic structure in thin type I superconductive films are reported. A sequence of magnetic structures were observed as film thickness was varied generating values for the critical thickness separating the single fluxoid state, the multifluxoid state, and the intermediate state for a thin superconductor. (JRD)

17240 OBSERVATION OF TILTED VORTICES BY MICROWAVE ABSORPTION. Monceau, P. (CNRS, Grenoble, France); Saint-James, D.; Waysand, G. pp 152-155 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Samples of PbIn (20 wt % In) were used in experiments in which the magnetic field is tilted thus inducing a periodic variation of the order parameter along the surface. Data on microwave absorption variation with respect to magnetic field orientation are presented in a graph showing a discrepancy at about 19°. This discrepancy is attributed to the entry of one vortex in the surface sheath of the superconductor. (JRD)

17241 MICROWAVE ABSORPTION IN DIRTY TYPE II SUPERCONDUCTING FILMS AROUND THEIR CRITICAL THICKNESS. Brunet, Y. (CNRS, Grenoble, France); Monceau, P.; Guyon, E.; Holzer, W.; Waysand, G. pp 156-159 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The variation of power reflected by a resonator as a function of magnetic field in PbIn films at constant temperature was measured. Results show evidence of a discontinuity of the mean-squared value of the order parameter at the flux entry. The results also justify the use of upper slope of the transition curve to check the theory. (JRD)

17242 EXPERIMENTAL EVIDENCE FOR THE THOMPSON TERM IN THE MICROWAVE CONDUCTIVITY OF TYPE II SUPERCONDUCTORS. Brunet, Y. (CNRS, Grenoble, France); Monceau, P.; Waysand, G. pp 160-162 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The surface impedance of superconducting Pb-In alloys was measured at 2.4 GH$_3$. Anisotropy of surface resistance found in the longitudinal and transverse orientations as a function of temperature is shown graphically. These data support Thompson's theory. (JRD)

17243 HIGHER-ORDER CORRECTIONS DUE TO THE ORDER PARAMETER TO THE FLUX FLOW CONDUCTIVITY OF DIRTY TYPE II SUPERCONDUCTORS. Takayama, H.; Maki, K. (Tohoku Univ., Sendai). pp 168-171 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of a study of the higher-order corrections in the order parameter to flux flow conductivity of type-II superconductors are presented. In the analysis, contributions from the regular range are distinguished from those of the anomalous frequency range. It is shown that the higher-order corrections expressed as the sum over the regular range always belong to the first class and can be neglected. Corrections to the term describing additional dissipation of electronic current due to presence of the order parameter can also be neglected. (JRD)

17244 DISSIPATION IN A SUPERCONDUCTING INDIUM WIRE. Sisemore, L. K.; Carroll, K. J.; Sikora, P. T. (Univ. of Oklahoma, Norman). pp 187-191 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A steady state delicate balance of currents existing when there is no dissipation in the axial wire of a coupled superconducting circuit is used to study the dissipation of energy in a current-carrying superconducting In wire. Data are presented in graphs and discussed. (JRD)

17245 FLUX MOTION IN LEAD-INDIUM WIRES WITH LONGITUDINAL MAGNETIC FIELDS. Nicholson, J. E.; Sikora, P. T.; Carroll, K. J. (Univ. of Oklahoma, Norman). pp 192-196 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of a theoretical and experimental investigation of the current-voltage characteristics of a type II superconducting Pb-In alloy wire are presented. Data for etched and unetched wire are presented and discussed. (JRD)

17246 FARADAY INDUCTION AND FLUX FLOW VOLTAGES IN TYPE II SUPERCONDUCTORS: EFFECT OF MAGNETIC FIELD AND TEMPERATURE. Khanna, S. M.; LeBlanc, M. A. R. (Univ. of Ottawa). pp 197-201 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The effects of temperature and applied static magnetic field on Faraday induction and flux flow voltages in Nb$_3$Zr wire were studied. Results show that configuration of the field profile across the thickness of the sample coil plays an important role in the preferential flux migration as the superconductor is heated asymmetrically to the normal state. (JRD)

17247 INVESTIGATIONS OF RESONANCES IN THE RF ABSORPTION OF SUPERCONDUCTING NIOBIUM. Kneisel, P.; Stoltz, O.; Halbritter, J. (Univ., Karlsruhe, Ger.). pp 202-206 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of investigations are presented on the surface impedance of superconducting Nb. Data are presented on surface resistance of anodized Nb as function of rf magnetic peak field for the TM$_{010}$ field, and temperature dependence of resonance absorption. (JRD)

17248 BOUNDARY CURRENT AND MODULATED FLUX MOTION IN SUPERCONDUCTING THIN Pb FILMS. Kim, Y. W.; de Graaf, A. M.; Chen, J. T.; Friedman, E. J. (Wayne State Univ., Detroit). pp 238-240 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The finding that the electric field associated with the flux motion driven by an rf current in superconducting thin Pb films can be amplitude modulated is analyzed. Results of the analysis show that the amplitude modulation and the phase reversal are independent of the rf frequency between 9.6 GH$_3$ and 30 MH$_3$. (JRD)

17249 ACHIEVEMENT OF NEARLY FORCE-FREE FLOW OF INDUCED CURRENTS IN RIBBONS OF Nb$_3$Sn. Lachaine, A.; LeBlanc, M. A. R. (Univ. of Ottawa). pp 247-251 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies on nearly force-free current flow in commercial ribbons of Nb$_3$Sn are reported. Data and observations on evolution of magnetization and remanent magnetization are presented and discussed. (JRD)

17250 EFFECT OF DC AND AC CURRENTS ON THE SURFACE SHEATH CONDUCTIVITY OF NIOBIUM SINGLE CRYSTALS. Callarotti, R. C. (Instituto Venzolano de Investigaciones Cienificas, Caracas). pp 252-256 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of resistive transition measurements in monocrystals of Nb in ac and dc magnetic fields at 4°K are presented. A model is proposed to describe properties of Nb in the surface sheath region. Results are presented graphically and discussed. (JRD)

17251 LINEWIDTH OF RELAXATION OSCILLATIONS OF A SHUNTED SUPERCONDUCTING POINT CONTACT. Sandell, R. D.; Puma, M.; Deaver, B. S. Jr. (Univ. of Virginia, Charlottesville). pp 264-267 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The spectrum of oscillations occurring when a superconducting weak link shunted with a small resistor and fed with a constant-current source as function of temperature was observed. It was found that the character of the spectrum changes periodically. The wave form is essentially sawtooth. (JRD)

17252 MICROWAVE EMISSION FROM COUPLED JOSEPHSON JUNCTIONS. Finnegan, T. F.; Wahlsten, S. (National Bureau of Standards, Washington, DC). pp 272-275 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Properties of the microwave radiation emitted by coupled Pb–PbO Josephson tunnel junctions (dc biased to radiate on either the usual or anomalous steps) were studied. Results provide a demonstration of the coherent superradiant state in simple two-junction systems. (JRD)

17253 APPLICATION OF THE SHUNTED JUNCTION MODEL TO POINT-CONTACT JOSEPHSON JUNCTIONS. Taur, Y. (Univ. of California, Berkeley); Richards, P. L.; Auracher, F. pp 276-280 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies are presented on the dc current–voltage characteristics of oxidized Nb–Nb point contacts as function of temperature, contact pressure, and rf power at 36 GH$_3$. Theoretical and experimental results are compared and discussed. (JRD)

17254 CHARACTERISTICS OF JOSEPHSON POINT CONTACTS AT THE CENTER OF A SPHERICAL CAVITY. DeReggi, A. S.; Stokes, R. S. (Univ. of Virginia, Charlottesville). pp 281-284 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of the characteristics of superconducting Nb–Nb point contacts located at the center of a spherical cavity of large diameter as compared with the wavelength of Josephson radiation in the millivolt range of interest are reported and analyzed. (JRD)

17255 FINE STRUCTURE IN THE ANOMALOUS DC CURRENT SINGULARITIES OF A JOSEPHSON TUNNEL JUNCTION. Chen, J. T.; Langenberg, D. N. (Univ. of Pennsylvania, Philadelphia). pp 289-292 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

New characteristics of anomalous dc current singularities in the current–voltage relations of Josephson tunnel functions are described. At low temperatures, each singularity can be resolved into several branches separated by voltages on the order of 1% of the singularity voltage. The radiation emission properties of function excitation modes associated with the various branches differ greatly. (JRD)

17256 TEMPERATURE DEPENDENCE OF THE CRITICAL CURRENT OF A DOUBLE JOSEPHSON JUNCTION. Halse, M. R.; Salleh, K. M. (Univ. of Kent, Canterbury, Eng.). pp 293-296 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements of the temperature dependence of the critical current of a solder blob (Clarke devices or slugs) double junction are presented. Data are presented and discussed on critical current vs temperature and critical current vs control current. (JRD)

17257 BULK TUNNELING MEASUREMENTS OF THE SUPERCONDUCTING ENERGY GAPS OF GALLIUM, INDIUM, AND ALUMINUM. Gregory, W. D.; Straus, L. S.; Averill, R. F.; Keister, J. C.; Chapman, C. (Georgetown Univ., Washington, DC). pp 316-323 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Progress in fabrication of large numbers of quality specimens of controlled orientation In, Al, and Ga superconductors is reviewed. Tunneling data from these samples are reported and analyzed. (JRD)

17258 TWO-PARTICLE TUNNELING IN SUPERCONDUCTING PbIn/OXIDE/Pb JUNCTIONS. Toxen, A. M.; Basavaiah, S.; Levine, J. L. (IBM T. J. Watson Research Center, Yorktown Heights, NY). pp 324-327 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of current–voltage characteristics of Pb–In/oxide/Pb junctions are presented which show structures associated with two-particle tunneling. (JRD)

17259 THEORY AND MEASUREMENTS ON LEAD–TELLURIUM–LEAD SUPERCURRENT JUNCTIONS. Seto, J.; Van Duzer, T. (Univ. of California, Berkeley). pp 328-333 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The theoretical derivation of the critical current as function of thickness and temperature of Te specimens is described. Hall effect measurements were made and the carrier concentration of Te was obtained. Using these values and those of the Schottky barrier dimensions, the energy band diagram as function of position was calculated by solving the Poisson equation. (JRD)

17260 TUNNELING FROM Pb INTO Al AND Sn IN PROXIMITY. Olafsson, R.; Woods, S. B. (Univ. of Alberta, Edmonton). pp 334-336 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The density of electronic states in proximity sandwiches of Al and Sn at 1.0 to 4.0°K were measured up to transition temperature using a Pb base layer as the electrode. It was found that the McMillan [Phys. Rev.; 175: 537(1968)] model describes weakly coupled thin-film proximity sandwiches of Al and Sn to their transition temperatures. (JRD)

17261 MAGNETIC FIELD DEPENDENCE OF THE PROXIMITY EFFECT IN THE Sn/Pb SYSTEM. Hook, J. R. (Manchester Univ., Eng.). pp 337-340 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The magnetic field dependence of the proximity effect in thin film Sn evaporated onto bulk Pb substrate was studied. Results of the study show that the Ginzburg–Landau equations describe the proximity effect in Sn thin films at higher temperatures. (JRD)

17262 SUPERCONDUCTING TUNNEL JUNCTION AS A VOLTAGE-TUNABLE SOURCE OF MONOCHROMATIC PHONON PULSES. Kinder, H. (Kernforschungsanlage, Juelich, Ger.). pp 341-344 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A method is described for generating tunable monochromatic phonon pulses by superconducting junctions. Bremsstrahlung superconducting tunnel junctions are used allowing a quantitative spectroscopy employing phonon pulses. (JRD)

17263 TUNNELING MEASUREMENTS OF ELECTRON SPIN EFFECTS IN SUPERCONDUCTORS. Meservey, R. (Massachusetts Inst. of Tech., Cambridge). pp 345-353 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements are given that were made during investigations of the thermodynamics of very thin Al films in high magnetic fields. These results are used to resolve the discrepancy between experimental results and theoretical Bardeen, Cooper, and Schrieffer [Bardeen et al., Phys. Rev.; 108: 1175(1957)] (BCS) results. (JRD)

17264 NMR ANOMALIES AND SUPERCONDUCTIVITY IN TRANSITION METALS: VANADIUM. Ganguly, B. N. (Univ. of Illinois, Urbana). pp 361-365 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of experiments are presented to show that in V, once the electron–phonon enhancement factor of electronic specific heat and the effective Coulomb enhancement factor of the spin susceptibility are properly taken into account, the anomalous nuclear spin-lattice relation is consistent with the hypothesis that the experimentally observed Knight shift in this element is due to orbital paramagnetism. (JRD)

17265 NUCLEAR MAGNETIC RESONANCE AND RELAXATION IN $V_3Ga_{1-x}Sn_x$. Fradin, F. Y.; Zamir, D. (Argonne National Lab., IL). p 366 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The basis of the dependence of the superconducting transition temperature (Tc) in this compound on the electronic structure was established by measuring the spin-lattice relaxation rate (T_1^{-1}), the isotropic Knight shift (Kiso) the axial Knight shift (Kax), and the electronic field gradient (g) at ^{51}V over the temperature range 1.6 to 300°K and over the frequency range 8 to 48.5 MHz. (JRD)

17266 ULTRASONIC EVIDENCE AGAINST MULTIPLE ENERGY GAPS IN SUPERCONDUCTING NIOBIUM. Almond, D. P.; Lea, M. J.; Dobbs, E. R. (Univ. of Lancaster, Eng.). pp 367-371 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Electronic attenuation in single-crystal Nb in the normal state and in the superconducting state was measured at low temperatures. Results show that all of the electronic attenuation is due to electrons associated with a BCS energy gap. No evidence was found for either a very small or an anomalously large energy gap. (JRD)

17267 SUPERCONDUCTING SPECIFIC HEAT OF Nb–Ta ALLOYS. Satoh, T.; Sawada, A.; Yamamoto, M. (Tohoku Univ., Sendai). pp 372-376 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of thermodynamic measurements show that the anomalous behavior found in the superconducting specific heat of Nb and Ta disappears at the impurity concentration where the impurity parameter becomes slightly larger than one, regardless of the nature of the impurity. (JRD)

17268 SUPERCONDUCTIVITY OF PROTACTINIUM. Fowler, R. D.; Asprey, L. B.; Lindsay, J. D. G.; White, R. W. (Los Alamos Scientific Lab., NM). pp 377-381 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Eight samples of Pa prepared by PaF_4 reductions were tested for superconductivity transitions. Repeated observations of superconducting transitions in tetragonal Pa show that this element is a superconductor. Pa is not a superconductor in the fcc phase except under pressure. (JRD)

17269 SUPERCONDUCTIVE TRANSITION IN CADMIUM. Schooley, J. F. (National Bureau of Standards, Washington, DC). pp 382-386 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of tests to determine the superconductive transitions of Cd in zero magnetic fields are reported along with results of studies on the effects of magnetic fields on Cd single-crystal transitions. (JRD)

17270 CONTRIBUTIONS AT THE La AND Sn–In SITES TO SUPERCONDUCTIVITY AND MAGNETISM IN $LaSn_xIn_{3-x}$ ALLOYS. Welsh, L. B. (Northwestern Univ., Evanston, IL); Toxen, A. M.; Gambino, R. J. pp 387-391 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of continuous wave and pulsed nuclear magnetic resonance measurements on $LaSn_xIn_3$ alloys are presented. Results show evidence that in the composition region near $LaSn_3$, the electrons at the La site are responsible for a large temperature-dependent paramagnetic susceptibility, while the superconducting behavior is largely determined by the local properties of the Sn–In sites. (JRD)

17271 VARIATION OF THE ELECTRON–PHONON INTERACTION STRENGTH IN SUPERCONDUCTING $LaIn_{3-x}Sn_x$. van Maaren, M. H.; Havinga, E. E. (Phillips Research Labs., Eindhoven, Netherlands). pp 392-394 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements of transition temperature and specific heat in $LaIn_{3-x}Sn_x$ samples are presented graphically. An observed inverse dependence of the Debye temperature and the electron–phonon coupling parameter shows the varying strength of the interaction between electrons and the lattice in this compound. (JRD)

17272 SUPERCONDUCTING PROPERTIES OF $LaSn_xIn_{3-x}$. Roy, P. K. (Columbia Univ., New York); Levine, J. L.; Toxen, A. M. pp 395-398 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of the transition temperature, density of states at the Fermi surface, Debye energy, and Vickers hardness of $LaSn_xIn_{3-x}$ are reported. Results are analyzed and used as a basis for understanding of superconductivity in these compounds. (JRD)

17273 CALORIMETRIC STUDIES OF SUPERCONDUCTIVE PROXIMITY EFFECTS IN A TWO-PHASE Ti–Fe (7.5 AT. %) ALLOY. Ho, J. C. (Wichita State Univ., KS); Collings, E. W. pp 403-407 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Data and information are presented to show that in the Ti–Fe alloy system the drop in superconducting transition temperature as the valence-electron-to-atom ratio decreases toward the value 4.1 is the result of a complete superconductive proximity effect. (JRD)

17274 HEAT CAPACITY OF RUBIDIUM TUNGSTEN BRONZE. Kienzle, W. E.; Bevolo, A. J.; Danielson, G. C.; Li, P. W.; Shanks, H. R.; Sidles, P. H. (Ames Lab., IA). pp 408-410 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements on tungsten bronze samples prepared by electrolysis of a melt consisting of RbCl and WO_3. Data are presented and discussed on heat capacity of Rb_xWO_3 in zero magnetic field and in 5 kG magnetic field. It is noted that the thermodynamics of this compound is complex. (JRD)

17275 SPECIFIC HEAT, OPTICAL, AND TRANSPORT PROPERTIES OF HEXAGONAL TUNGSTEN BRONZES. King, C. N.; Benda, J. A.; Greene, R. L.; Geballe, T. H. (Stanford Univ., CA). pp 411-415 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements of the specific heat and optical properties of Rb_xWO_3 ($x \sim 1/3$) are compared with data on those properties of Na_xWO_3 ($0.5 < x < 1$). It was found that hexagonal tungsten bronze Rb_xWO_3 has an additional Einstein mode related to heat capacity and anisotropy in reflectivity not present in Na_xWO_3. It appears that superconductivity transition is related to the anisotropic nature of hexagonal bronzes. (JRD)

17276 INFLUENCE OF THE LIMITS OF PHASE STABILITY AND ATOMIC ORDER ON SUPERCONDUCTIVITY OF BINARY

AND TERNARY A15-TYPE COMPOUNDS. Muller, J.; Flukiger, R.; Junod, A.; Heiniger, F.; Susz, C. (Univ., Geneva). pp 446-456 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

An analysis of factors governing superconductivity in A15-type compounds is presented. The analysis is conducted by detailed studies on two ternary members of this group namely Nb–Au–Pt, and V–Au–Pt alloys. Data on phases in these alloys are presented and discussed along with data on lattice specific heat, and electronic specific heat. (JRD)

17277 IMPORTANCE OF THE TRANSITION METAL VOLUME IN A15 SUPERCONDUCTORS. Cadieu, F. J.; Weaver, J. S. (City Univ. of New York, Flushing). pp 457-460 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies on the compressibility and phase stability of V_3Si at pressures up to 300 kbar are presented. Experimental data suggest that small distortions in the V_3Si lattice do not significantly affect the superconducting transition temperature at high pressure. It is noted that the transition temperature of V_3Si at 300 kbar can only be estimated at present. (JRD)

17278 T_c STUDIES OF Nb–Ga BINARY AND TERNARY COMPOUNDS. Deis, D. W.; Hulm, J. K. (Westinghouse Research Labs., Pittsburgh). pp 461-464 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Studies of $Nb_{1-x}Ga_x$ and $Nb_{0.70-\gamma}M_\gamma Ga_{0.30}$ materials are reported where M is Mo, Ta, Ti, or Zr. Results on $Nb_{1-x}Ga_x$ indicate that high-transition temperature material is best obtained by quenching from high temperatures. In the $Nb_{0.70-\gamma}M_\gamma Ga_{0.30}$ compounds the depression of the transition temperature grows steadily larger through the sequence Mo, Ta, Ti, and Zr. (JRD)

17279 SYNTHESIS OF LOW-TEMPERATURE STABLE SUPERCONDUCTING A15 COMPOUNDS IN THE NIOBIUM SYSTEM. Hammond, R. H. (Stanford Univ., CA); Hazra, S. pp 465-467 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies are presented on the superconducting properties of binary Nb–Ge, Nb–Ga, and Nb–Si systems. Experimental results on Nb–Ge and Nb–Ga systems confirmed the dependence of the transition temperature on the increased order derived from stoichiometry. It is suggested that in order to maximize the transition temperature range for Nb_3Si the film should be deposited on the substrate at about 600°C. (JRD)

17280 STUDIES OF SUPERCONDUCTING $Nb_3A_xB_{1-x}$ ALLOYS. Johnson, G. R.; Douglass, D. H. (Univ. of Rochester, NY). pp 468-471 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Pseudobinary alloys in the form $Nb_3A_xB_{1-x}$ where A and B represent the nontransition elements Al, Ga, Ge, and Si were prepared and studied using x-ray diffraction. Data are presented and analyzed on lattice parameters of these compounds as function of temperature. (JRD)

17281 SUPERCONDUCTIVITY IN THE ALLOY SYSTEM $V_3Ga_xSi_{1-x}$. Deaton, B. C.; Gordon, D. E. (General Dynamics, Fort Worth, TX). pp 475-479 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Superconducting onsets at measured resistivity of greater than 18°K in $V_3Ga_xSi_{1-x}$ are reported. A transition temperature of 18.6°K was obtained for the $V_3Ga_{0.25}Si_{0.75}$ compound and a transition temperature of 18.2°K for the $V_3Ga_{0.5}Si_{0.5}$ compound by subjecting these materials to homogenization at 1000°C followed by a 700°C anneal. (JRD)

17282 SUPERCONDUCTING PROPERTIES OF A15 PHASE V–Ir ALLOYS. Cox, J. E. (Naval Research Lab., Washington, DC); Bostock, J.; Waterstrat, R. M. pp 480-484 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The A-15 phase samples studied ranged from $V_{61}Ir_{39}$ to $V_{75}Ir_{25}$. Results show that increasing crystallographic long-range order in A-15 system does not always increase the transition temperature. By varying the composition in the direction of increasing Ir from stoichiometric $V_{75}Ir_{25}$, the transition temperature can be increased. (JRD)

17283 SUPERCONDUCTING PROPERTIES OF SOME VANADIUM-RICH TITANIUM–VANADIUM ALLOY THIN FILMS. Spitzer, H. J. (Army Mobility Equipment Research and Development Center, Fort Belvoir, VA). pp 485-489 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies on superconducting properties of Ti–V alloys are presented. Crystallographic methods revealed that the samples were β-phase Ti–V solid solutions with a bcc lattice configuration partly mixed with an unidentified hexagonal material. (JRD)

17284 SUPERCONDUCTIVITY OF LUTETIUM AT VERY HIGH PRESSURE: IMPLICATIONS WITH RESPECT TO THE SUPERCONDUCTIVITY OF LANTHANUM. Wittig, J. (Kernforschungsanlage Juelich, Ger.); Probst, C.; Wiedemann, W. pp 490-494 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies on pressure-induced superconductivity in Lu are presented. The study was conducted to interpret the results as they apply to La. It is inferred from the relatively high transition temperature of La in different phases and in La intermetallic compounds that the reason for this is the inner 4F scattering resonance on the La ion. (JRD)

17285 SUPERCONDUCTIVITY OF HAFNIUM AND THE DEPENDENCE OF T_c ON PRESSURE. Probst, C. (Bayerische Akademie der Wissenschaften, Garching, Ger.); Wittig, J. pp 495-497 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of preliminary studies of Hf superconductivity at very high pressures are presented. Data are presented and discussed on transition temperature vs pressure for Hf samples containing 2.3 and 1.5 at. % Zr. (JRD)

17286 SUPERCONDUCTING PROPERTIES OF IRIDIUM. Soulen, R. J. Jr. (National Bureau of Standards, Washington, DC); Gubser, D. U. pp 498-502 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of experiments are reported in which the residual resistivity ratio, magnetization measurements, critical magnetic field data, and superconductive transition temperature measurements on Ir are correlated in a program to determine the properties of this superconductor. It was found that the superconductive properties of pure Ir are represented by a transition temperature of 122m°K and a Hc (0) of 17×10^{-4} T. (JRD)

17287 EFFECT OF STRESS ON THE MAGNETIC SUPERCONDUCTING TRANSITIONS OF TIN WHISKERS. Rothberg, B. D.; Nabarro, F. R. N.; McLachlan, D. S. (Univ. of the Witwatersrand, Johannesburg). pp 503-506 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of studies on Sn whiskers incorporates a superconducting phase diagram as a function of variable magnetic field, temperature, and elastic strain. Data are presented graphically and discussed on critical field vs strain at various temperatures, and on critical field as function of temperature at various strains. (JRD)

17288 STRAIN DEPENDENCE OF T_c IN Sn AND In ALLOY WHISKERS. Cook, J. W. Jr.; Davis, W. T.; Chandler, J. H.; Skove, M. J. (Clemson Univ., SC). pp 507-509 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of the effects of alloying on the strain dependence of the superconducting transition temperature of In and Sn whiskers are reported. Results are discussed and presented in graphs on transition temperature vs strain in In–Sn and In–Pb whiskers and on transition temperature change with strain in Sn–Bi alloy. (JRD)

17289 EFFECT OF SIZE AND SURFACE ON THE SPECIFIC HEAT OF SMALL METAL PARTICLES. Novotny, V. (Univ. of Toronto); Meincke, P. P. M.; Watson, J. H. P. pp 510-514 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Observations of an anomalous behavior in the electronic specific heat resulting from boundary conditions on the electronic wave functions affecting quasiparticle states in small metal particles are reported. Enhancement of lattice specific heat found in metal particles and porous glasses was due to low-frequency surface phonon modes and the effect of finite size on lattice specific heat. (JRD)

17290 PRESSURE-INDUCED SUPERCONDUCTIVITY IN CESIUM. Stocks, G. M. (Oak Ridge National Lab., TN); Gaspari, G. D.; Gyorffy, B. L. pp 515-516 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of calculations of pressure-induced superconductivity in Cs are presented. The transition temperature at 36 kbar was calculated to be 1.1°K. (JRD)

17291 INFLUENCE OF DISSOLVED HYDROGEN ON THE SUPERCONDUCTING PROPERTIES OF MOLYBDENUM. Bhardwaj, B. D.; Rorschach, H. E. (Rice Univ., Houston, TX). pp 517-522 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The effects of interstitial H on the electronic and mechanical properties of Mo were investigated. Results of anisotropy parameter calculations are given along with data on variation of supercooling rates with temperature. (JRD)

17292 SUPERCONDUCTIVITY OF ELASTICALLY STRAINED TIN WHISKERS NEAR $T_c\epsilon$: A SECOND-DEGREE PHASE TRANSITION WITH TWO DEGREES OF FREEDOM. Rothberg, B. D.; Nabarro, F. R. N.; Stephen, M. J.; McLachlan, D. S. (Univ. of the Witwatersrand, Johannesburg). pp 528-531 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of the experiments are presented in graphs on critical field as function of temperature at various strains for Sn whiskers of [001] orientation and [100] orientation. Analyses and discussions of the data are included. (JRD)

17293 EXPERIMENTAL EVIDENCE FOR AN ATOMIC-LIKE PARAMETER CHARACTERIZING AND SYSTEMATICS OF SUPERCONDUCTIVITY IN THE TRANSITION METALS. Hammond, R. H. (Stanford Univ., CA); Collver, M. M. pp 532-536 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Evidence based on literature data for crystalline transition metals indicating that the parameter η which characterizes the systematics of superconductivity in these metals has a peak in the center of the 4d series. The peak in η as shown by amorphous transition temperature data also exists in the crystalline state. (JRD)

17294 MODIFICATION OF SURFACE MODE FREQUENCIES AND SUPERCONDUCTIVITY T_c BY ADSORBED LAYERS. Naugle, D. G.; Baker, J. W.; Allen, R. E. (Texas A and M Univ., College Station). pp 537-542 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Evidence of the effects of surface phonons on the transition temperature in Bi, Al, Sn, and Tl is reported. Transition curves for clean films and films with condensed Ar or Ne are included showing a decrease in transition temperature when the noble gases were adsorbed. The shift in transition temperature in these metals is due to modification of surface phonon frequencies. (JRD)

17295 EFFECT OF SURFACE CHARGE ON THE SUPERCONDUCTIVITY OF VANADIUM FILMS. Felsch, W. (Univ. of Maryland, College Park). pp 543-546 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The effects of changes in electrostatically induced surface charge on the superconducting transition temperature and residual normal-state conductivity of V thin films were studied. Results indicate that increasing the electron concentration causes an increase in the transition temperature. (JRD)

17296 CARRIER CONCENTRATION AND THE SUPERCONDUCTIVITY OF BERYLLIUM FILMS. Yoshihiro, K.; Glover, R. E. III. (Univ. of Maryland, College Park). pp 547-551 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of Hall coefficients are reported on Be superconducting phase and hcp phase. Results show that a thickness-independent Hall coefficient of $+1.6 \times 10^{-4}$ cm³/C for the high-transition temperature modification. It appears that an increase in density of states occurring in quench-condense films is responsible for the high observed transition temperature. (JRD)

17297 UPPER CRITICAL FIELD AND THE DENSITY OF STATES IN AMORPHOUS SUPERCONDUCTORS. Bergmann, G. (Kernforschungsanlage, Juelich, Ger.). pp 552-557 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements of upper critical field and density of states in films of $Bi_{0.85}Tl_{0.15}$, Ga, $Sn_{0.86}Cu_{0.14}$, and $Pb_{0.75}Bi_{0.25}$ are presented and discussed. (JRD)

17298 SUPERCONDUCTIVITY AND METASTABILITY IN ALLOYS OF THE Mo–Re SYSTEM. Gavaler, J. R.; Janocko, M. A.; Jones, C. K. (Westinghouse Research Lab., Pittsburgh). pp 558-562 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Properties and structures in thin films of Mo–Re alloys were studied. It was found that sputtered films of Mo-rich A15 phase and Re-rich A15 phase are superconducting to ~15°K. (JRD)

17299 SUPERCONDUCTIVITY PROPERTIES OF CRYSTALLINE FILMS OF ALUMINUM ON SILICON. Strongin, M.; Kammerer, O. F.; Farrell, H. H.; Crow, J. E. (Brookhaven National Lab., Upton, NY). pp 563-567 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Superconductivity of ultrathin Al films on Si was studied. It was found that the transition temperature of Al films is not very much higher than that for bulk Al. Films evaporated with more gas have higher transition temperatures, and films oxidized by exposure to air also have increased transition temperatures. (JRD)

17300 GRANULAR REFRACTORY SUPERCONDUCTORS. Watson, J. H. P. (Corning Glass Works, New York). pp 568-572 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Preparation of superconductors in granular form having very high critical fields is described. Results of calculations for granular superconductors such as Pb–40% Bi alloys and $NbC_{0.3}N_{0.7}$ are given. These results indicate that the critical currents and critical fields in these alloys and refractories should greatly exceed those of presently available superconductors. (JRD)

17301 STRUCTURAL AND SUPERCONDUCTING PROPERTIES OF GRANULAR ALUMINUM FILMS. Deutscher, G.; Fenichel, H.; Gershenson, M.; Grunbaum, H.; Ovadyahu, Z. (Tel Aviv Univ., Israel). pp 573-577 of Low Temperature Physics: LT13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of the lattice parameters, grain size distributions, and normal-state resistivity of granular Al films are reported. Relations of these films with the superconducting transition were studied. Large critical fluctuations found in the films are responsible for their weaker superconducting properties. (JRD)

17302 PHONON SPECTRUM OF LA. Lou, L. F.; Tomasch, W. J. (Univ. of Notre Dame, IN). pp 599-602 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

It is noted that a strong-coupling theory may provide an adequate description of La, thus allowing a phonon spectrum to be extracted. Effects due to F levels are reflected by anomalous values of the electron-phonon coupling strength or effective Coulomb pseudopotential obtained in the course of computing the phonon spectrum. (JRD)

17303 SIMPLE EXPERIMENT FOR THE DETERMINATION OF THE BCS PARAMETER IN NORMAL METALS. Deutscher, G. (Tel Aviv Univ., Israel); Valette, C. pp 603-606 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

It is shown that measurement of the screening length in superconductors as function of the temperature provides an easy way to determine the electron-electron BCS parameter (NV) of N, without requiring any mean free path or film thickness measurement. (JRD)

17304 VARIATIONS OF CUTOFF PHONON FREQUENCIES IN STRONG-COUPLING SUPERCONDUCTORS. Rothwarf, A. (Univ. of Pennsylvania, Philadelphia); Rothwarf, F.; Rao, C. T.; Dubeck, L. W. pp 607-610 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of experiments and calculations are presented to show that the ratio $2\,\Delta/k\,Tc$, where Δ is the zero-temperature energy gap and Tc is the transition temperature, can be used to determine an effective Phonon cutoff temperature which provides information about the relative importance of longitudinal and transverse phonons in their interaction with electron superconductors. (JRD)

17305 SOFT TRANSVERSE PHONONS IN AN AMORPHOUS METAL. Golding, B.; Bagley, B. G.; Hsu, F. S. L. (Bell Telephone Labs., Murray Hill, NJ). pp 623-626 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The vibrational properties of a bulk amorphous intermetallic compound $Pd_{0.775}\,Si_{0.165}\,Cu_{0.06}$ were studied. It was found that changes in the density of states of vibrational modes strongly influence the properties of this compound. It is not possible to quantitatively estimate the effect of changes in density of states on superconducting transition temperature for dense superconducting glasses by considering a thin film evaporated superconductor as a model. (JRD)

17306 LATTICE STRUCTURE AND INSTABILITIES AND ELECTRON-PHONON COUPLING IN SUPERCONDUCTORS WITH HIGH TRANSITION TEMPERATURES. Hertel, P. (Univ., Saarbrueken, Ger.). pp 627-630 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

An analysis is presented of lattice instabilities and phonon spectral anomalies in superconductors having high transition temperatures. It was found that the best way to attain high transition temperature is to start with materials having covalent bonding forces. Because of high Debye temperature in these materials the phonon spectrum could be softened and the lattice stiffness decreased by changes in structures or alloying. (JRD)

17307 ONE-DIMENSIONAL SUPERCONDUCTIVITY IN BISMUTH FILMS. Shigi, T.; Kawate, Y., Yotsuya, T. (Osaka City Univ.). pp 633-637 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The effects of annealing of amorphous Bi films on their superconducting properties and on one-dimensional superconductivity associated with them were studied. It was found that at about 10.5°K rapid crystallization of the Bi film occurs in a small temperature interval, leaving a two-dimensional network of amorphous regions at crystal boundaries. One-dimensional behavior was not found in well annealed Be films. (JRD)

17308 EVIDENCE FOR MAGNETIC-FIELD-INDUCED REDUCTION OF THE FLUCTUATION DIMENSIONALITY IN BULK TYPE II SUPERCONDUCTORS JUST ABOVE THE CRITICAL FIELD H_{c_2}. Hake, R. R. (Indiana Univ., Bloomington). pp 638-641 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Comparison of experimental and theoretical curves shows that as the applied magnetic field decreases toward the upper critical field the anisotropy factor increases in accord with theory. A phase diagram of a type-II superconductor is included along with curves representing reduced resistive voltage in $Ti_{84}\,Mo_{16}$ vs applied magnetic field. (JRD)

17309 FLUCTUATION CONDUCTIVITY OF SUPERCONDUCTORS. Patton, B. R. (Univ. of California, San Diego, La Jolla). pp 642-648 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A review of research on fluctuations in superconductivity is presented along with a description of recent calculations in this area. (JRD)

17310 CRITICAL FLUCTUATION BEHAVIOR IN THE RESISTIVE TRANSITION OF SUPERCONDUCTING Bi FILMS. Chien, M. K.; Glover, R. E. III. (Univ. of Maryland, College Park). pp 649-653 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements are reported on the resistive transition of superconducting Bi films in the critical fluctuation region close to the transition temperature and in the temperature range just below the transition temperature. The approach to zero with decreasing temperature of the resistance of Bi films on smooth substrates is much more rapid than that previously reported for Al films. (JRD)

17311 STUDY OF FLUCTUATION EFFECTS ON RESISTIVE TRANSITION TO SUPERCONDUCTIVITY IN THIN INDIUM FILMS. Bhatnagar, A. K.; Gallardo, B. (St. John's Univ., Jamaica, NY). pp 654-658 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements were made of the enhanced conductivity of thin In films. Data were analyzed to obtain the enhanced conductivity value for each film. These data are tabulated and discussed. (JRD)

17312 FLUCTUATION EFFECTS IN THE AC IMPEDANCE OF ONE-DIMENSIONAL SUPERCONDUCTORS. Miller, J. R.; Pierce, J. M. (Univ. of Virginia, Charlottesville). pp 659-663 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The present status of a study of the ac complex impedance of filamentary tin whisker crystals in the transition region is described. (JRD)

17313 FUNCTIONAL INTEGRAL METHOD FOR SUPERCONDUCTING CRITICAL PHENOMENA. Takayama, H. (Tohoku

Univ., Sendai). pp 664-668 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Methods of conducting diagrammatic analysis of the dynamic properties of superconductors are described. Applications to zero-dimensional superconductors are reviewed along with applications to higher-dimensional superconductors. (JRD)

17314 ISOTHERMAL SUPERCONDUCTING TRANSITIONS IN MILLIGAUSS FIELDS. Schreiber, R.; Rorschach, H. E. (Rice Univ., Houston, TX). pp 669-672 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Preliminary observations are reported on departures from mean-field theories applicable to temperature ranges near the transition temperature in superconducting Re as determined by measuring the magnetization in milligauss fields. It was found that the transition temperature shows no indication of any singularity, but drops smoothly to the normal-state specific heat value within an interval of about 1 m°K. (JRD)

17315 FLUCTUATION-INDUCED DIAMAGNETISM ABOVE T_c IN Al AND Al-Ag ALLOYS. Kaufman, H.; de la Cruz, F.; Seidel, G. (Brown Univ., Providence). pp 673-676 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Observations are reported on enhanced diamagnetism in bulk, cylindrical single crystals of pure Al and its alloys with Ag. The diamagnetism occurs above the thermodynamic transition temperature and is attributed to formation of an appreciable number of Cooper pairs due to fluctuations in the superconducting order parameter. (JRD)

17316 THERMODYNAMIC FLUCTUATIONS IN ZERO-DIMENSIONAL SUPERCONDUCTORS. Buhrman, R. A.; Halperin, W. P.; Webb, W. W. (Cornell Univ., Ithaca, NY). pp 682-686 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The magnetic superconducting transition of very small insulated Al particles was studied to evaluate the effects of thermodynamic fluctuations on this transition. Results indicate that the behavior of superconductors within the critical region exhibits no strikingly unusual effects and is about as expected on the basis of calculations. (JRD)

17317 SIZE EFFECTS IN THE FLUCTUATION DIAMAGNETIC SUSCEPTIBILITY OF INDIUM POWDERS ABOVE T_c. McLachlan, D. S. (Univ. of the Witwatersrand, Johannesburg). pp 687-691 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Experiments were conducted to observe the fluctuation diamagnetic susceptibility in In powders above the transition temperature by an ac susceptibility method. Results show that fluctuation-induced conductivity in In is not a contributing factor in diamagnetic susceptibility. (JRD)

17318 FLUCTUATIONS IN A SMALL SUPERCONDUCTING GRAIN. Deutscher, G. (Tel Aviv Univ., Ramat Aviv, Israel); Imry, Y.; Gunther, L. pp 692-695 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Fluctuations of the order parameter in single small superconducting grains were studied. A scaling law between the three-dimensional and zero-dimensional indices was derived. The specific heat does not show any singular behavior in the critical region, and the smearing of the phase transition due to finite size is in agreement with recent theory. (JRD)

17319 COHERENT BEHAVIOR IN JOSEPHSON JUNCTION ARRAYS. Saxena, A. (Brookhaven National Lab., Upton, NY); Crow, J. E.; Strongin, M. pp 696-700 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of experiments are reported on arrays of Josephson junctions made by compressing small Al particles. Results appear to show coherent behavior. It was observed that a steady zero-bias dc voltage is across the sample when rf power is incident on it. (JRD)

17320 INSTABILITIES IN THE VOLTAGE-CURRENT CHARACTERISTICS OF CURRENT-CARRYING ONE-DIMENSIONAL SUPERCONDUCTORS. Meyer, J.; von Minnigerode, G. (Univ., Cologne). pp 701-704 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Data and observations on voltage steps in transition curves of current carrying thin Sn wires and whiskers are reviewed along with data on mean-field critical temperature of whiskers and voltage-current characteristics of whiskers. (JRD)

17321 INTRINSIC FLUCTUATIONS IN A SUPERCONDUCTING FLUX DETECTOR RING CLOSED BY A JOSEPHSON JUNCTION: THEORY AND EXPERIMENT. Jackel, L. D.; Kurkijaervi, J.; Lukens, J. E.; Webb, W. W. (Cornell Univ., Ithaca, NY). pp 705-708 of Low Temperature Physics: LT 13. Vol 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of thermal fluctuations in superconductors dominated by fluxoid quantization are reported. The probability distribution of transitions between fluxoid states as function of temperature, critical current, and the distribution shape is in agreement with calculations of other workers. Results indicate that the Josephson equations adequately describe the weak link in this system. (JRD)

17322 PAIR-FIELD SUSCEPTIBILITY OF SUPERCONDUCTORS. Anderson, J. T. (Stanford Univ., CA); Carlson, R. V.; Goldman, A. M.; Tan, H. T. pp 709-714 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of theoretical and experimental work on susceptibility associated with superconductivity as determined by dc tunneling are presented. The current-voltage characteristics $Al-Al_2O_3-Pb$ tunneling junctions biased from a constant-current source were measured. Results appear to be quantitatively consistent with theory except in the immediate vicinity of the transition temperature. (JRD)

17323 HIGH-RESOLUTION MAGNETOOPTICAL EXPERIMENTS ON MAGNETIC STRUCTURES IN SUPERCONDUCTORS. Kirchner, H. (Siemens AG, Munich). pp 717-727 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Methods of investigating magnetic structures in superconductors are reviewed. Data and information are included on high-resolution magnetooptical techniques, instrumental limitations, intermediate structures in superconducting lead, bulk superconductor experiments, and intermediate state in type II superconductors. (JRD)

17324 INVESTIGATION OF POSSIBILITIES FOR RAISING THE CRITICAL TEMPERATURE OF SUPERCONDUCTORS. Zharkov, G. F. (Lebedev Physical Inst., Moscow). pp 729-734 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A review of developmental work directed to production of superconductors having high transition temperatures is presented. Possibilities for realization of exciton mechanisms triggered by electron reactions with atoms and molecules in the superconductor leading to higher transition temperatures are discussed. It is noted that no definite procedure for obtaining high-temperature superconductivity can be indicated. (JRD)

17325 RESISTANCE OF SUPERCONDUCTING ALLOYS NEAR T_c AS CAUSED BY VORTEX STRUCTURE MOTION. Gor'kov, L. P.; Kopnin, N. B. (Inst. for Theoretical Physics, Moscow). pp 735-739 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The conductivity was measured of a superconductor in magnetic fields having a vortex near the transition temperature. It was found that the anomalous term used in the equations becomes significant at finite temperatures; the viscosity experienced by the moving vortex lines therefore increases. (JRD)

17326 ANISTROPY OF THE STATIC MAGNETIC FIELD PENETRATION DEPTH IN SUPERCONDUCTING TIN. Tai, P. C. L.; Beasley, M. R.; Tinkham, M. (Harvard Univ., Cambridge, MA). pp 740-744 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements are reported of magnetic field penetration depth in superconducting tin monocrystalline disks. Results of the measurements made in semifinite plane geometry to facilitate comparison with theory provide a demonstration of the dependence of the magnetic field penetration depth on the normal to the sample surface. (JRD)

17327 ULTRASONIC ATTENUATION IN SUPERCONDUCTING INDIUM AND INDIUM-TIN ALLOYS. Brickwedde, F. G.; Binnie, David E.; Reed, R. W. (Pennsylvania State Univ., University Park). pp 745-749 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements of ultrasonic attenuation in pure In and in dilute In-base alloys with Sn in the [100], [001], and [110] directions are presented. Results show that there was no amplitude dependent attenuation. Alloying reduces the attenuation by augmenting the number of impurity centers for pinning the dislocations. (JRD)

17328 LOW-TEMPERATURE ANOMALIES IN PURE NIOBIUM STUDIED ULTRASONICALLY. Leibowitz, J. R. (Catholic Univ. of America, Washington, DC); Alexander, E.; Blessing, G.; Francavilla, T. pp 750-755 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Unusual magnetic-field-independent effects encountered in normal and superconducting states of high-purity Nb are examined and discussed. Information and data are included on BCS case I absorption in Nb, electromagnetic coupling in Nb, and N-state absorption in Nb. (JRD)

17329 ULTRASONIC ABSORPTION IN SUPERCONDUCTING SINGLE CRYSTALS OF $Nb_{1-x}Mo_x$. Lacy, L. L. (Marshall Space Flight Center, Huntsville, AL). pp 756-759 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of ultrasonic absorption measurements are presented on type-II superconducting $Nb_{1-x}Mo_x$ alloys. Results indicate that an additional decrease in attenuation would occur if lower temperatures could be achieved. A preliminary estimate of BCS gap parameter $A = 4.2$ is questionable and should probably be closer to $A \approx 3.7$. (JRD)

17330 VOLUME CHANGE AT THE SUPERCONDUCTING TRANSITION OF LEAD AND ALUMINUM ABOVE 0.3°K. Ott, H. R. (Eidgenoessische Technische Hochschule, Zurich). pp 760-762 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements of Pb and Al volumes in superconducting and normal state are presented. Data on pressure and volume derivatives of superconducting parameters of these elements are tabulated and compared with similar results obtained by other workers. (JRD)

17331 NUCLEAR SPIN-LATTICE RELAXATION IN IMPURE SUPERCONDUCTING INDIUM. Williamson, J. D.; MacLaughlin, D. E. (Univ. of California, Riverside). pp 763-766 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of a series of nuclear spin-lattice relaxation measurements on superconducting In-base, InGa, InCd, InTl, and InPb dilute alloys are presented. Results indicate that the dependence of nuclear spin-relaxation time on temperature and solute concentration is inconsistent with the assumption that the only gap broadening mechanisms are energy gap anisotropy and quasiparticle-damping mechanism. (JRD)

17332 ELECTRONIC PART OF THE THERMAL CONDUCTIVITY OF A THIN, SUPERCONDUCTING FILM COMPOSED OF LEAD AND GADOLINIUM. Ginsberg, D. M.; Mrstik, B. J. (Univ. of Illinois, Urbana). pp 767-771 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Effects of impurity spin ordering on transition temperatures and the thermal conductivity of Pb-base Pb-Gd films were studied. Results indicate that rare earth paramagnetic impurities have a different effect on superconducting properties than nonrare earths and the effects of non-rare earths are poorly understood. (JRD)

17333 OBSERVATION OF PAIR-QUASIPARTICLE POTENTIAL DIFFERENCE IN NON-EQUILIBRIUM SUPERCONDUCTORS. Clarke, J. (Univ. of California, Berkeley). pp 798 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A difference was observed between the pair potential and the quasiparticle potential in $Al-Al_2O_3-Sn$ tunnel junctions. The potential difference closely followed the theoretical prediction. (JRD)

17334 EFFECT OF SINTERING AND HEAT TREATING VARIABLES ON THE PROPERTIES OF PREALLOYED IRON/NICKEL/MOLYBDENUM POWDER COMPACTS. Holcomb, R. T.; Lovenduski, J. H. Technical Paper No. MF73-226. Dearborn, MI; Society of Manufacturing Engineers (1973). 20p.

The effects of thermal treatment variables encountered on sintering and heat treating have been evaluated for prealloyed Fe/Ni/Mo powder compacts over the 6.0 to 7.0 g/cc range at combined C contents from nil to 0.8%. Transition of property control from porosity to structure within the P/M density range was indicated by increased sensitivity of properties to processing variables with increasing density. (Metals Abstr.)

17335 TEMPERATURE DEPENDENCE OF THE INTERNAL FRICTION OF SOME BINARY ALLOYS. Zheltonogov, P. A. Uch. Zap., Kabardino-Balkar. Gos. Univ.; No. 39, 113-116(1972). (In Russian).

Curves were obtained for the temperature dependence of the internal friction of some alloys of eutectic composition: (i) Sn-32% Cd and (ii) Sn-57% Bi. The curves have peaks at 135 and 100°C, respectively, for alloys (i) and (ii), these peaks being associated with intensification of the mutual solubility of the alloy components. The shear moduli decrease linearly with increasing temperature but close to the peak temperature there is a deviation from linearity. (Ref. Zh.)

17336 PHYSICOCHEMICAL INVESTIGATION OF YTTRIUM INTERACTION WITH RUTHENIUM AND IRON GROUP ELEMENTS. Tolkunova, E. F.; Burnashova, V. V.; Raevskaya, M. V.; Sokolovskaya, E. M. Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 5, 559-562(1974). (In Russian).

The isothermal sections of the ternary systems Y-Fe-Ru and Y-Co-Ru at 600°C were plotted utilizing x-ray phase, microstructure, and local x-ray spectral analyses. Y-Fe-Ru was studied over all the range of concentrations. Y-Co-Ru was investigated in the region 0 to 33 at. % Y. A large solubility of the third component in the binary compounds YMe_2 (Me = Ru, Fe, Co), YMe_3 (Me = Fe, Co), and Y_2Me_{17} (Me = Fe, Co) was found. Ternary compounds were not detected. (auth)

17337 COMPOSITES: STANDARDS, TESTING, AND DESIGN. Proceedings of a Conference Held at Teddington, England, April 8-9, 1974. Guildford, Eng.; IPC Science and Technology Press, Ltd. (1974). 164p. $27.90.

Recent studies on the analysis, testing, design, and application of various composite materials (reinforced composites, fiber composites, reinforced glass and plastics, reinforced cement and thermoplastics, etc.) are presented. Some topics include tension-compression experiments on a fiber-reinforced composite of Cu–W, prediction of properties for engineering design with composites, applications of advanced composites in aircraft structures, pyrolytic surface treatment of graphite fibers, acoustic emission and fatigue of reinforced plastics, specifications of fiber-reinforced cements, time dependence and anisotropy of the stiffness of fiber-plastics composites, and dynamic testing and performance of unidirectional carbon fiber–carbon composites. A separate abstract of the paper on Cu–W was prepared. (IAA)

17338 TENSION–COMPRESSION EXPERIMENTS ON A FIBRE REINFORCED COMPOSITE OF Cu–W. Lilholt, H. (Atomenergikommissionen, Riso, Denmark). pp 17-19 of Composites: Standards, Testing, and Design. Guildford, Eng.; IPC Science and Technology Press, Ltd. (1974).

From conference on composites: standards, testing, and design; Teddington, Eng. (8 Apr 1974).

Specimens of single crystal copper with between 1 and 4 vol % of parallel tungsten wires of diameter of 20 microns were tested at room temperature in tension and compression through cycles of constant plastic strain amplitudes (Bauschinger tests). The data were used to evaluate the (experimental) back stress of the composites; a preliminary comparison with recent theories of back stresses in two-phase materials indicates that the composite at room temperature behaves as a perfect memory solid (no relaxation of dislocation structures). (auth)

17339 EFFECTS OF THE INITIAL STATE OF MOLYBDENUM (TECHNICAL GRADE) ON ITS SHORT-TIME HIGH-TEMPERATURE STRENGTH. Kidin, I. N.; Belyakov, B. G.; Kryanina, M. N.; Mochalov, B. V. Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 3, 135-139(1974). (In Russian).

The short-time properties of cold-deformed Mo, and Mo in which a polygonization structure had first been created by preliminary treatment, were studied during high-speed heating. The effect of the heating rate, in the region of recrystallization temperature on the dislocation structure of the initial cold-deformed metal, was also investigated. There is a polygonization substructure in Mo after the preliminary heating of the cold-deformed metal at rates of 1 and 10°C/s. This has a beneficial effect on increasing the short-time high-temperature strength. (Metals Abstr.)

17340 RARE-EARTH METALS, ALLOYS, AND COMPOUNDS. Meder, V. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). 356p. (In several languages).

The chemistry of rare-earth metals and their compounds, and the influence of rare-earth metals on the properties of ferrous and nonferrous metals and alloys are reviewed. Possible applications of rare-earth alloys in such fields as electronics, catalysis, metallurgy, biology, medicine, and agriculture are examined. The phase diagrams and composition vs property curves of recently developed metallic and oxide systems are presented. The magnetic properties of rare-earth metals and their iron compounds are studied, along with methods of preparing high-strength permanent magnets. The use of computers in physicochemical investigations of rare-earth metals is described. (IAA)

17341 HEAVY GAUGE ASME SA 533 GRADE B, CLASS 1 STEEL PLATE FOR NUCLEAR REACTOR PRESSURE VESSELS. Kusuhara, Y. (Kawasaki Steel Corp., Kobe, Japan); Yoshimura, S.; Ogino, Y.; Enami, T.; Funakoshi, T. Kawasaki Seitetsu Giho; 6: No. 2, 174-198(Apr 1974). (In Japanese).

ASME SA 533 Gr. B Class 1 steel plates for nuclear reactor pressure vessels have been made for test purpose by means of combined use of LD converter and ASEA-SKF ladle refining furnace (LRF) in the melting and refining process. In order to secure proper strength, high fracture toughness, and excellent internal soundness of the steel, as well as to confirm their reproducibility, tests were conducted five times, using a 60 to 80 ton ingot for each heat. The results are found satisfactory, and steel plates obtained have a superior internal soundness with lesser nonmetallic inclusions, confirming what is usually known of LRF refined steels. The steel, even in 240 mm thickness, showed proper strength and high fracture toughness. These results and other tests conducted on uniformity of mechanical properties and fracture toughness across total dimensions of the plates, fracture toughness based on large specimens, low cycle fatigue, and workability, confirmed that the subject steel has such properties to permit good nuclear reactor pressure vessel fabrication. (JA)

17342 PHASE STRUCTURE OF ALLOYS IN THE Ti–V SYSTEM. Molokanov, V. V.; Budberg, P. B. Dokl. Akad. Nauk SSSR; 215: No. 5, 1125-1127(1974). (In Russian).

The possibility of the monotectoid conversion in the system is studied. Six alloys were used with contents of 30, 40, 50, 60, 66.7, and 80 at. % V. The alloys were studied by microstructural, x-ray-structural, and x-ray-microspectral analysis, as well as measurement of microhardness and resistivity. Experimental data were used to refine the phase state of alloys in the system at temperatures below 600°C. The position of the $\alpha + \beta/\beta$ phase boundary indicates the general nature of conversions in the systems with positive interaction parameter and metastable imiscibility curve. The studies showed no exfoliation of the β solid solution with its related monotectoid conversion of alloys. (JPRS)

17343 EFFECTS OF COOLING RATES AND TEMPERING CONDITIONS ON THE STRENGTH AND TOUGHNESS OF Mn–Ni–Mo, Cr–Mo STEEL PLATES. Enami, T.; Sato, S.; Tanaka, T.; Funakoshi, T. (Kawasaki Steel Corp., Chiba, Japan). Kawasaki Seitetsu Giho; 6: No. 2, 145-161(Apr 1974). (In Japanese).

The strength, ductility, and notch toughness of Mn–Ni–Mo and Cr–Mo steels for pressure vessel are shown at the different level of cooling rates and tempering conditions. These results are summarized as follows: (1) Along with an increase in the tempering parameter, defined by T (20 + log t) where T is temperature and t is holding time, the strength lowered continuously, but the ductility and the toughness gradually improved, passed through a maximum value, and finally lowered. (2) The tempering parameter corresponding to maximum toughness was found to depend on cooling rates for Mn–Ni–Mo steel, but not for Cr–Mo steel. Level of maximum toughness, however, changed with cooling rates for both steels. (3) With respect to ductility, neither tempering parameter corresponding to maximum value nor level of maximum value much depended on cooling rates for both steels. (JA)

17344 MECHANICAL PROPERTIES OF Cu–W FIBER COMPOSITES PREPARED BY DIFFUSION BONDING. Taborsky, L.; Havalda, A.; Ivan, J.; Schichor, R.; Sebo, P. (Ustav Kovovych Materialov, Bratislava). Kovove Mater.; 12: No. 1, 108-117 (1974). (In Slovak).

17345 MOLYBDENUM-BASED ALLOYS. Shulepov, V. I.; Yudkovskii, S. I.; Il'inskii, V. S.; Popova, Yu. S.; Akif'ev, S. K.; Nikishanov, V. V. USSR Patent 382,730. 9 Mar 1973. Filed date 5 Oct 1971. (In Russian).

An Mo-based alloy of the following composition is suggested (in %): Ti 3.2 to 24, C 0.8 to 6, Mo–remainder. The alloy is designed for use at high temperatures and differs in that the C and Ti are taken in a ratio of 0.2 : 0.3. The mechanical properties of the alloy Mo–3.2% Ti–0.8% C at 1000°C are: σ_b 62 kg/mm^2, σ_t 52.8 kg/mm^2, δ 5.9%, ψ 46.7%. At 1400° with a stress of 8 kg/mm^2, the time to rupture is over 1500 h; with a stress of 10 kg/mm^2 the time to rupture is 97.5 h. (Referativnyi Zh.)

17346 NIOBIUM ALLOY FOR THE ELASTIC COMPONENTS OF DEVICES OPERATING AT ELEVATED TEMPERATURES. Vasil'eva, E. V.; Gorbova, A. S.; Prokoshkin, D. A.; Volin, E. M.; Vergasova, L. L. (Moscow Higher Technical School). Mashinostroene; No. 8, 173-174(1974). (In Russian).

Mechanical and elastic characteristics, heat resistance and creep were investigated at 700 and 800°C in a niobium alloy containing 26.4% Ti and 5.5% Al. The alloy was produced in an electric-arc vacuum furnace with a consumable electrode, was hot-pressed and repeatedly rolled at different temperatures prior to and after extrusion. Numerical results of tests are included. The high strength and elastic performance of the alloy and its fairly high heat resistance are noted. (IAA)

17347 STUDY OF FRACTURE SURFACES IN TUNGSTEN FIBER REINFORCED COPPER-MATRIX COMPOSITES. Taborsky, L.; Havalda, A.; Ivan, J.; Schichor, R.; Sebo, P. (Ustav Kovovych Materialov, Bratislava). Kovove Mater.; 12: No. 2, 243-250(1974). (In Slovak).

The mechanism of failure in tensile loading, the matrix-matrix diffusion bond strength, and the fiber matrix adhesive bond strength were studied by electron microscopic observation of fracture surfaces in copper-matrix laminate composites reinforced with 0.2 mm diameter tungsten fibers. Two types of samples tested involved either diffusion bonding of copper foil in vacuum or galvanic deposition of the copper matrix. Effects of temperature (room temperature of 300°C) are described together with features of matrix and fiber failure. (IAA)

17348 EFFECT OF TREATING LIQUID METAL WITH A FLUORINATED PLASTIC (TEFLON) ON THE STRUCTURE AND PROPERTIES OF NICKEL-BASED CREEP RESISTANT ALLOYS. Filatova, M. A.; Matveeva, G. T.; Sashchikhin, N. N.; Chaplygin, A. A. Tr., Tsent. Nauch.-Issled. Inst. Tekhnol. Mashinostr.; No. 107, 83-89(1972). (In Russian).

Results are given from tests on treating liquid Ni-base alloys with teflon, the tests being carried out on industrial 5-ton melts of EI437 [Nimonic 80] and EI698 [C 0.08, Cr 13 to 16, Ti 2.35 to 2.75, Al 1.3 to 1.7, Mo 2.8 to 3.2, B 0.005, Ce 0.005, Fe < 2, and

Nb 1.8 to 2.2%]. The treatment results in a reduction in gas saturation, an improvement in the surface of the billets, and improved working during hot treatment. These property changes are the result of structural changes in the metal. (Referativnyi Zh.)

17349 SEGREGATION OF ALLOY ELEMENTS IN TERNARY NICKEL ALLOYS WITH ORIENTED STRUCTURE. Sittner, M.; Tuma, H. (Statni Vyzkumny Ustav Materialu, Prague). Kovove Mater.; 12: No. 2, 176-187(1974). (In German).

The investigation reported shows that the exponential dependence of the segregation coefficients of cobalt and niobium in the ternary Ni–Co–Si and Ni–Nb–Si alloys has the same form for nonoriented and oriented structures. An addition of silicon produces a reversal in the direction in which segregation takes place in the case of cobalt in nickel. No such reversal is observed in the case of niobium. The presence of silicon enhances the concentration differences between cobalt and niobium in the crystals and the grain boundaries. (IAA)

17350 STUDY OF THE TRANSFORMATIONS DURING CONTINUOUS COOLING OF THE TA6V6E2-Zr TITANIUM ALLOY. Hourcade, M.; Hocheid, B.; Beauvais, C. (Conservatoire National des Arts et Metiers, Paris). Mem. Sci. Rev. Met.; 71: 95-103 (Feb 1974). (In French).

Results are presented of a systematic metallographic study (at room temperature) of samples of TA6V6E2-Zr alloy quenched at various rates in water, oil, or air and by other techniques. A detailed account is given of the phase structure observed following the various types of quenching, noting some uncertainties which remain concerning the evolution of the martensitic transformation temperature when the alpha phase appears and concerning the formation of the hypothetical omega phase. (IAA)

17351 PROPERTIES OF WELDMENT OF HEAVY-SECTION REACTOR-VESSEL STEEL PLATE. Hiro, T.; Nishiyama, N.; Tsuboi, J.; Okabe, R.; Mori, T. (Kawasaki Steel Corp., Chiba, Japan). Kawasaki Seitetsu Giho; 6: No. 2, 199-216(Apr 1974). (In Japanese).

Using a 170 mm thick plate of A533, Grade B, Class 1 steel characteristics of weldments by a submerged arc and a covered arc are studied. The plate is fabricated by Ladle-Refining-Furnace, using a forging press of 6,000-ton capacity. A combination of high basic agglomerated flux KB-150A and wire KW-40C for submerged arc welding and an ultra low hydrogen type electrode KS-86A for covered arc welding are prepared for securing the joint efficiency. Weldments using a submerged arc and a covered arc are found to have no defects, excellent tensile properties and bending ductilities, as well as sufficient absorbed energies and NDT temperatures for meeting the requirements of ASTM or ASME specifications. (JA)

17352 STABILITY OF A15 TYPE PHASES. Hartsough, L. D. (Univ. of California, Berkeley). J. Phys. Chem. Solids; 35: No. 12, 1691-1701(Dec 1974).

Previous works dealing with the stability of the A15 phases are reviewed. Data for over 60 known A15 phases are used to develop criteria for stability which may be applied to hypothetical A15 phases. Occurrence of these phases is examined in terms of the valence bond concepts of the Engel-Brewer correlation, and in its frequency with changes in electronic density of states. A15 is most favored when the "A" elements are V, Nb, or Cr, when radii of the constituent atoms differ by no more than 8 per cent, at compositions determined by electron concentration, and at relatively low temperatures. Composition and temperature of formation are predicted for several likely hypothetical A15 phases, including some in the following binary systems: V–Re, Nb–Re, Mo–Re, Ta–Al, Ta–Ga, W–Ru, and Zr–Sb. (auth)

17353 DE HAAS–VAN ALPHEN EFFECT AND FERMI SURFACE CHANGES IN DILUTE ALLOYS. Coleridge, P. T. (National Research Council of Canada, Ottawa). pp 9-18 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A review is presented of work on dilute alloys where the effects of defects are dominated by a single impurity of known concentration. It is now possible to determine the alloy Fermi surfaces using the same procedures as used for pure metals; the volume of this Fermi surface corresponds approximately to the average number of electrons per atom in the alloy. It is also possible to determine an effective potential that yields a band structure which, in the region of the Fermi level, fits the experimental data. The de Haas–van Alphen effect gives information on the way the impurity differs from the host atoms and how it scatters the conduction electrons out of the pseudo-Bloch states. (37 references) (DLC)

17354 THERMAL AND MAGNETIC PROPERTIES OF METALS AT LOW TEMPERATURES. Isihara, A. (Univ., Alberta, Canada). pp 47-49 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Improvements are made on the many-body (correlation energy of electron gas at 0°K) theories of the low-temperature behavior of metals. Equations are derived for the specific heat, its temperature dependence, and susceptibility. De Haas–van Alphen oscillations (true Fermi momentum) are discussed. Exchange and correlation energies in the limit of intense magnetic field and low temperature are evaluated. (DLC)

17355 DOPPLERONS IN TUNGSTEN. Carolan, J. F. (Univ. of British Columbia, Vancouver). pp 75-78 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The Doppleron (Doppler-shifted cyclotron resonance mode) can be distinguished from the Gantmakher–Kaner size-effect oscillations by circular polarization. This was tested for the [110] direction in W. Results show a definite polarization dependence in the rf transmission which indicates the presence of Dopplerons. (DLC)

17356 DE HAAS–VAN ALPHEN EFFECT IN YZn, AN ALLOY OF THE BETA-BRASS TYPE. Jan, J. P. (National Research Council of Canada, Ottawa). pp 100-103 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The effect was measured in the $\{100\}$ and $\{110\}$ planes in ordered β'–YZn. The signals were weak and difficult to observe. Results are examined in terms of two models of the Fermi surface, the nearly-free-electron (NFE) and the APW models. The NFE model more nearly agrees with experiment than the APW model. (DLC)

17357 DE HAAS–VAN ALPHEN EFFECT IN TECHNETIUM. Arko, A. J.; Crabtree, G. W.; Hoernfeldt, S. P.; Ketterson, J. B.; Kostorz, G.; Windmiller, L. R. (Argonne National Lab., IL). pp 104-108 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The effect was measured in zone-refined Tc single crystals in the $(\bar{1}100)$ and (0001) planes. The frequencies are assigned to the Fermi surfaces. Effective masses for these frequencies are tabulated. (DLC)

17358 DE HAAS–VAN ALPHEN EFFECT AND THE ELECTRONIC STRUCTURE OF THE TRANSITION METALS. Windmiller, L. R.; Hoernfeldt, S.; Shaw, J.; Crabtree, G.; Ketterson, J. B. (Argonne National Lab., IL). pp 120-130 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Improvements in the de Haas–van Alphen (dHvA) effect for the study of the Fermi surface of metals are described. The major disadvantage of dHvA measurements is that they produce orbital averages of Fermi surface parameters; this has been overcome by inversion procedures. A chart of the transition metals shows the status of dHvA studies of each metal: experimental, band structure calculation, and parameterization of the Fermi surface properties. Pd and Ir are discussed as examples. (7 fig, 16 references) (DLC)

17359 HOLE OCTAHEDRON FERMI SURFACE CURVATURE IN TUNGSTEN. Soule, D. E.; Abele, J. C. (Douglas Advanced Research Lab., Huntington Beach, CA). pp 136-141 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Magnetomorphic size effect measurements were made on (100) and (110) tungsten single crystals (RRR = 42,000) 90.5 to 230 μ

thick. The orbital area derivative is shown as a function of magnetic field direction in the (110) and (100) principal planes. The hole octahedron term, which was dominant, was compared with several models and with other experimental studies. (DLC)

17360 MAGNETIC-FIELD-INDUCED PSEUDO PHASE TRANSITION IN CADMIUM. Hagen, D. E.; Tefft, W. E.; Sparlin, D. M. (Univ. of Missouri, Rolla). pp 162-166 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Magnetic "kink" fields that are necessary to produce a Lifshitz electron transition are considered. Available magnetostriction data for Cd were fit to a theoretical equation and the parameters found. (DLC)

17361 THE FERMI SURFACE OF DILUTE INDIUM ALLOYS. Holtham, P. M. (Univ. of British Columbia, Vancouver); Parsons, D. pp 222-225 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.).. New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

DeHaas-van Alphen measurements are reported of the changes that occur in the third zone electron surface when In is alloyed with Pb (0.5 and 1%) as Tl (0.25 and 0.5%). Neither a rigid band model nor a pseudopotential model with spin-orbit coupling agrees with the experimental results. (DLC)

17362 HALL RESISTIVITY IN DILUTE CRYSTALS OF Cd-In AND Cd-Ag: AN IMPURITY PROBLEM FOR INTERSHEET SCATTERING. Lilly, D. A.; Gerritsen, A. N. (Purdue Univ., Lafayette, IN). pp 236-240 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Single crystals of Cd alloys containing small amounts of Ag or In showed no sign reversal at 0.04 at. %. ρ_{21} increases below 30°K for all samples; at 15°K, ρ_{21} reaches a maximum. It is felt that intersheet scattering is inhibited for a range of low impurity contents (ppM) and becomes manifest only in samples of purity comparable to pure Cd. (DLC)

17363 PHONON-EXCHANGE VERTEX IN TRANSITION METALS: A LOCALIZED APPROACH. Gutfreund, H.; Birnboim, A. (Hebrew Univ. of Jerusalem). pp 247-252 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The natural way of formulating the Cooper-parity mechanism in transition metals with narrow d bands is by employing the Wannier or atomic site representation. This approach is applied to Nb and V crystals; the irreducible phonon-exchange vertex is calculated for the tight-binding, modified tight binding, and screened cases. (DLC)

17364 T_c IN DILUTE Nb-Ta ALLOYS ESTIMATED FROM RESISTIVITY MEASUREMENTS. Rapp, O.; Pokorny, M. (Royal Inst. of Tech., Stockholm). pp 253-257 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A simple model is used to investigate whether the observed anomaly in the electronic specific heat γ of Nb-Ta alloys (0 to 30 at.% Ta) can be included in a calculation of T_c together with the estimated electron-phonon coupling V_{ph}. The band structure density of states is calculated from the specific heat density of states. Agreement between calculated and observed γ is good considering the crudeness of the model. T_c is also calculated and found to agree within 5% with experiment. The observed monotonic T_c decrease with Ta content is obtained with McMillan's formula. (DLC)

17365 ELECTRON-PHONON INTERACTION IN LEAD AND INDIUM: STUDY BY HIGH-FREQUENCY CYCLOTRON RESONANCE. Goy, P.; Castaing, B. (Ecole Normale Superieure, Paris). pp 258-268 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Temperature and frequency variations of the electron-phonon interaction were studied in lead and indium by cyclotron resonance at high frequency. All predicted effects are observed but the frequency effects are generally smaller than expected. Because of the larger λ and the lower E_t, lead should give larger effects than indium, but experimental results do not show any significant difference. (7 figs) (auth)

17366 ELECTRON-PHONON INTERACTION AND ELECTRONIC PROPERTIES OF ZINC. Tomlinson, P. G.; Swihart, J. C. (Indiana Univ., Bloomington). pp 269-273 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Elements that enter the calculation of electron-phonon effects for the prediction of anisotropic properties are reviewed briefly. The electron-phonon interaction in Zn is then calculated. Results for the real Fermi surface and several OPWs are compared with those for a single OPW on a spherical Fermi surface. It is concluded that in order to understand anisotropic properties, the effects of band structure should not be ignored. (DLC)

17367 ELECTRONIC MEAN FREE PATHS IN CADMIUM. Hambourger, P. D. (Cleveland State Univ.). pp 278-281 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The temperature dependence of the mean free path was measured for three orbits on the Fermi surface of Cd, using the size-dependent oscillatory magnetoresistance effect. The orbits studied were two highly complex orbits on the second-band "monster" and one simple orbit on the third-band "lens." (DLC)

17368 MAGNETOACOUSTIC EFFECT IN NIOBIUM. Leibowitz, J. R. (Catholic Univ. of America, Washington, DC); Alexander, E. M.; Blessing, G. V.; Francavilla, T. L.; Peverley, J. R. pp 287-291 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Transverse and longitudinal magnetoacoustic oscillations in Nb were studied for calipers of its Fermi surface. It is shown that, under appropriate conditions, the transverse waves may provide greater caliper sensitivity than the longitudinal waves and thereby enhance the usefulness of the magnetoacoustic effect for Fermi surface studies. (DLC)

17369 ULTRASONIC SHEAR WAVE ATTENUATION AND THE ELECTRONIC STRUCTURE OF CADMIUM AND ZINC. Almond, D. P.; Birks, A. R.; Lea, M. J.; Dobbs, E. R. (Univ. of Lancaster, Eng.). pp 320-324 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

Measurements of the electronic attenuation were made down to 0.1°K on high-purity single crystals of Cd and Zn. The acoustic mode studied was the fast shear mode with both acoustic wave vector and polarization in the basal plane. Results indicate that the "butterflies" and "cigars" previously predicted in the Fermi surface do not exist. (DLC)

17370 EFFECT OF SURFACE CONDITION ON THE LORENZ NUMBER AND OTHER ELECTRON TRANSPORT PROPERTIES OF SIZE-LIMITED SINGLE-CRYSTAL TUNGSTEN RODS. Baer, D. R.; Wagner, D. K. (Cornell Univ., Ithaca, NY). pp 373-378 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The electric and thermal resistivities at 1.5 to 5.5°K and of the longitudinal magnetoresistance at 4.2°K were measured in variously oriented W single-crystal rods 0.13 to 3 mm diameter. Surface treatments (etching, polishing, sandblasting) affect the electric resistivity more than the thermal one. The surface condition also affects the Lorenz number; deviations from the Wiedemann-Franz law are ascribed to the polished condition. Results can be explained if the surface scattering is somewhat specular for the electro-polished surface and predominantly diffuse for the electroetched and sandblasted surfaces, and if the electron mean free path for thermal conduction is shorter than that for electrical conduction. (DLC)

17371 SPECIFIC HEAT OF STRONGLY DISORDERED CRYSTALLINE AND AMORPHOUS FILMS. Buckel, W.; Ohlerich, C. (Univ., Karlsruhe, Ger.). pp 437-440 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The Eliashberg function $\alpha^2(\omega)F(\omega)$ in the attractive electron–phonon interaction is increased at low frequencies for disordered films in tunneling. In order to determine whether this increase is mainly due to a change of $\alpha^2(\omega)$ or of $F(\omega)$, the specific heat was measured in In, Pb, amorphous Pb–33 at.% Bi, and amorphous Bi–12 at.% Sb after quench-condensation at 1.8 to 6°K. Results show that the specific heat ratio tends to increase with decreasing temperature. From comparison with calculations by Happel, assuming that $\alpha^2(\omega)$ does not depend on disorder, results indicate that the change of the Eliashberg function in tunneling cannot be understood by only a change in $F(\omega)$. (DLC)

17372 HEAT CAPACITY MEASUREMENTS ON ISOTOPES OF MOLYBDENUM. Viswanathan, R. (Univ. of California, San Diego La Jolla); Luo, H. L.; Engelhardt, J. J. pp 445-448 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The measurements were made on enriched Mo isotopes ^{92}Mo, ^{98}Mo, and ^{100}Mo in the arc-cast and reprocessed states at 1.5 to 20°K. The Debye temperature θ_D is much higher for the arc-cast than for the reprocessed samples, and reprocessing results in an increased slope in the C/T vs T^2 plot. θ_D is proportional to $M^{-\alpha}$, where $\alpha = -0.503 \pm 0.005$ for arc-cast and -0.497 ± 0.008 for the reprocessed samples. (DLC)

17373 BEHAVIOR OF MAGNETIC AND NONMAGNETIC IMPURITIES IN THE SYSTEM $Nb_{76}Pt_{24-x}Fe_x$. Bongi, G. (Univ., Geneva); Fluekiger, R.; Treyvaud, A.; Fischer, O.; Jones, H.; Schneider, D. J. Low Temp. Phys.; 17: No. 3-4, 223-246(Nov 1974).

Iron is magnetic when introduced as an impurity in the A-15 superconductor $Nb_{76}Pt_{24}$. The ternary diagram of the system Nb–Pt–Fe is presented. The Fe impurities show a magnetic behavior when they are on the linear chains (Nb sites) and a nonmagnetic behavior when they are on the cubic sites (Pt sites). On the basis that the Fe atoms have a pair-breaking effect as well as a nonmagnetic effect on the superconducting state and determining the latter by adding nonmagnetic impurities (Ru), the measured critical field can be fitted as a function of temperature to the WHH theory generalized to include magnetic impurities. The analysis shows that the exchange interaction J between conduction electrons and the Fe atoms is negative. A Jaccarino–Peter compensation effect takes place at about 2 at. % Fe. The inverse Fe susceptibility curves are fitted using a model of short-range interactions between impurities. (auth)

17374 NATURE OF THE TRANSITION AT H_{c2} IN LOW-KAPPA TYPE-II LEAD–INDIUM SUPERCONDUCTING ALLOYS. Ehrat, R.; Rinderer, L. (Lausanne Univ., Switzerland). J. Low Temp. Phys.; 17: No. 3-4, 255-273(Nov 1974).

The anomalous magnetic and calorimetric properties at H_{c2}, reported for a lead–indium sample, are in agreement with the prediction of a bulk first-order phase transition from recent theories for critical κ superconductors ($\kappa \approx 1/\sqrt{2}$). Results of other experiments however, indicate that this behavior is an effect of the superconducting surface sheath. In an attempt to clarify the issue, magnetization and specific heat measurements are reported on two samples with nominal concentrations of 1.9 and 1.4 at. % indium in lead. The latter is type I above 6°K (T_c = 7.12°K). It is shown that surface effects are relevant for the effect reported previously. However, after empirical surface treatments have been applied to eliminate or at least minimize such effects, most of the results for the sample, which fulfills the theoretical requirements, are in agreement with theoretical predictions of Fischer, Usadel, and Jacobs. A bulk first-order transition at H_{c2} is thus, nevertheless, likely to occur for strong-coupling type II superconductors with critical κ values. (auth)

17375 THERMAL CONDUCTIVITY OF NIOBIUM IN THE PURELY SUPERCONDUCTING AND NORMAL STATES. Kes, P. H.; Rolfes, J. G. A.; de Klerk, D. (Univ. of Leiden). J. Low Temp. Phys.; 17: No. 3-4, 341-364(Nov 1974).

The thermal conductivity λ of four niobium samples has been measured between 1 and 10°K, both in the superconducting and normal states. The specimens differed in their crystal defect structures due to annealing at different temperatures (dislocations, grain boundaries) and, in one case, to subsequent fast neutron irradiation (dislocation loops). A procedure has been developed with which the electron and phonon contributions to the thermal conductivity can be separated with an accuracy not hitherto obtainable. All the samples proved to have the same energy gap at 0°K: $\Delta(0) = (1.95 \pm 0.02)kT_c$. The phonon conductivity in the superconducting state λ_p^s has been compared with the formula of Bardeen, Rickayzen, and Tewordt extended for scattering mechanisms other than phonon–electron interaction. For the unirradiated samples at $T \lesssim 0.15\ T_c$, λ_p^s is proportional to T^2, showing that dislocations are mainly responsible for the phonon scattering. The results are qualitatively in agreement with the theory of Klemens, giving a rough indication that the grain boundaries may be considered as arrays of line dislocations. Dislocation loops introduced by the neutron irradiation turn out to behave like clusters of point defects. A second consequence of the irradiation is an enhancement of the original dislocation scattering term. (auth)

17376 SUPERCONDUCTIVITY AND LATTICE DYNAMICS OF GRANULAR TIN. Akselrod, S. (Tel Aviv Univ., Israel); Pasternak, M.; Bukshpan, S. J. Low Temp. Phys.; 17: No. 3-4, 375-383(Nov 1974).

The superconducting transition temperature was measured in samples of 45-Å Sn grains embedded in a tin oxide matrix. The Debye temperature of the same samples was measured by the Moessbauer effect in ^{119}Sn in order to detect possible changes in the phonon spectrum. It was found that T_c is enhanced by 10% and θ is decreased by 4% relative to the bulk. Both trends are found to fit quantitatively with McMillan's theory of strong-coupling superconductors. The microstructure and the chemical composition of the samples were thoroughly studied by electron microscopy and the Moessbauer hyperfine interaction. Several conclusions were derived on the nature of the grains and their interaction with the dielectric coating. (auth)

17377 LOW CARBON AND STABILIZED 2-¼% CHROMIUM 1% MOLYBDENUM STEELS. Conference Held at Cleveland, Ohio, October 19–22, 1970. Metals Park, OH; American Society for Metals (1973). 171p. (CONF-701080-).

Data and information on behavior and mechanical properties of Cr–Mo steels are presented. Articles are included on ferritic steels for reactor systems, Cr–Mo steels with Nb additions, properties of low-C Cr–Mo steels, effects of high temperature Na, and heat-affected zones. (JRD)

17378 KINETICS OF THE REACTION FOR THE RELEASE OF HYDROGEN ON CATHODES PREPARED FROM TUNGSTEN, RHENIUM, AND THEIR ALLOYS. Makaryan, E. M.; Kudryashov, I. V.; Kamyshchenko, S. D. (Moscow Chemical-Technological Inst.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 11, 1647-1649(1974). (In Russian).

The kinetic parameters of the reaction of the cathode release of H_2 from 1.0 N KOH and Na_2SO_4 solutions on W, Re, and their alloys were determined. The activity of these materials with respect to the reaction of cathode release of H_2 is correlated with the physical-mechanical properties of these materials. (tr-auth)

17379 CARBIDE FORMATION IN ISOTHERMAL DISINTEGRATION OF SUPER-COOLED AUSTENITE IN Mo STEELS. Permyakov, V. G.; Pal'shin, G. I.; Chernenko, V. S.; Popova, L. N. (Kiev Polytechnic Inst.). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 8, 111-114(1974). (In Russian).

Carbide formation in Mo steels containing 0.4 and 0.2% C in isothermal disintegration was studied at 600 to 700°C. Using a differential magnetic method and x-ray phase analysis of the isolated carbides, the type of carbide formed was determined as a function of the Mo:C ratio in the steel and the temperature of isothermal disintegration. The specific magnetism of the carbide $Mo_{23}C_6$ at a Curie temperature of 300°C was determined. (tr-auth)

17380 EFFECT OF HIGH-TEMPERATURE PLASTIC DEFORMATION ON SEPARATION OUT OF NIOBIUM CARBIDE IN LOW-CARBON STEEL. Farber, V. M.; Mikhailova, O. M.; Davydov, V. N.; Chesnokova, N. N. (Ural Polytechnic Inst., Sverdlovsk, USSR). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 8, 82-85(1974). (In Russian).

Electron-microscope analysis of carbon-extraction replicas was used to study the effect of plastic-deformation heating regimes on the separation out of dispersed NbC particles in 10 GB steel. Plastic deformation at 800 to 1000°C accelerated the separation from the solid solution more than did the higher temperature of austenization or the lower temperature of deformation. Much of this NbC formed upon cooling of the samples after high-temperature deformation, chiefly in ferrite. The causes of these effects are discussed. (tr-auth)

17381 EFFECT OF Si, Mo, AND Ti ON THE MECHANICAL PROPERTIES OF AUSTENITIC STEEL X15H20. Baraz, V. R.; Popova, L. E.; Grachev, S. V.; Rol'shchikov, L. D. (Ural Polytechnic Inst., Sverdlovsk, USSR). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 8, 79-81(1974). (In Russian).

The structure and mechanical properties of X15H20 (up to 2% each of Si, Mo, and Ti in the alloy) austenitic steel after plastic deformation were studied. The effect of chemical composition, amount of deformation, and aging regime on the strength and plasticity was investigated, and, using an electron micro-diffraction method, the nature of the second-phase particles, which separate when austenitic steels are aged, was analyzed. (tr-auth)

17382 EFFECT OF SUPERQUICK HARDENING FROM THE LIQUID STATE ON THE STRUCTURE FORMATION AND PHASE COMPOSITION OF NIOBIUM ALLOYS. Savitskii, E. M.; Ivanova, K. N.; Revyakin, A. V.; Glyuzitskii, B. D. (Inst. of Metallurgy, Moscow). Dokl. Akad. Nauk SSSR; 213: No. 6, 1289-1291(21 Dec 1973). (In Russian).

The effect of a very fast cooling rate during quenching on the structure of Nb-based alloys of the Nb–W–Zr(Hf)–C system was studied. Microstructural, electron microscopic, and x-ray phase analyses were used to study the structure of the alloys after a crystallization rate calculated as (5 to 7) × 10^{6}°/s. In the Nb–W–Zr–C alloy the metastable ϵ phase Nb_3C_2 with traces of Nb_2C was precipitated. This phase was not detected in Nb–W–Hf–C alloys. In these alloys the carbide particles were coherently bound to the matrix. A mechanism was proposed for the decomposition of the supersaturated solid solution in these alloys. (JSR)

17383 PHASE DIAGRAMS FOR CHROMIUM WITH SAMARIUM AND YTTERBIUM. Svechnikov, V. N.; Kobzenko, G. F.; Ivanchenko, V. G. (Inst. of Metals Physic, Kiev). Dokl. Akad. Nauk SSSR; 213: No. 5, 1062-1064(11 Dec 1973). (In Russian).

Phase equilibria and the phase diagrams of the Cr–Sm and Cr–Yb systems were studied. The Cr–Sm alloys were prepared by electron-beam fusion and the Cr–Yb alloys by the ampule method. Metallographic, differential thermal, and microdurometric analyses were made of both alloys and the Cr–Sm alloy was also studied by x-ray structural analysis. The metallographic analysis showed that in the concentration interval from 100% Cr up to 85 at. % Sm statification occurs in the liquid state. The very limited solubility of the components of the Cr–Yb system in both the solid and liquid state was established by metallographic analysis. The differential thermal analysis showed that the temperature of eutectic transformation is somewhat lower in the Cr–Sm system than in the Cr–Yb system. Phase diagrams were constructed on the basis of these data and literature data. The almost complete non-miscibility in the liquid and solid states in the Cr–Yb system is explained by the characteristics of the electron structure of Yb. (JSR)

17384 ORDERING IN THE ALLOYS Ni_4Mo AND $Ni_{78.6}Mo_{19}V_{2.4}$. Vlasova, E. N.; Tyapkin, Yu. D.; Plakhtii, V. D. (Inst. of Physics of Metals and Metal Science, Moscow). Dokl. Akad. Nauk SSSR; 214: No. 2, 308-311(11 Jan 1974). (In Russian).

The initial stages of ordering in alloys with the stoichiometric composition Ni_4Mo and the effect of small additions of V (~2.4 at. %) on the character of the structural transformations were studied. An analysis of the diffraction diagrams leads to the conclusion that the scattering region around the superlattice node of the Ni_4Mo phases has a disk structure parallel to the {001} plane order with fct lattice. In alloys with addition of V the diffraction patterns are analogous to those obtained with Ni_4Mo and are not altered after annealing at 800°C for 3 h. In this alloy, however, after short-time annealing at 700°C there are three ordered phases: phases with DO_{22} structure, ordered Ni_2Mo phases, and Ni_4Mo phases. (JSR)

17385 VUS-6 Nb ALLOYS FOR ELASTIC RESPONSIVE ELEMENTS USED AT TEMPERATURES UP TO 700°C. Eliseev, S. A.; Shpitsberg, A. L.; Savinov, A. T. Tsvetn. Metal.; No. 9, 64-65 (Sep 1974). (In Russian).

Mechanical, physical, and engineering properties of the alloy VUS-6 at room and higher temperatures are presented. The alloy has a high relaxation resistance at 700 to 750°C, and the modulus of elasticity is temperature stable. (tr-auth)

17386 WETTING OF REFRACTORY METALS BY OXIDE MELTS. Elyutin, V. P.; Mitin, B. S.; Grits, E. F. (Moscow Inst. of Steel and Alloys). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 723-725(May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 844-846(May 1974).

Results of investigations show that the contact angle of wetting of W, Mo, and Nb by melts of Al_2O_3-based binary oxide systems increases with the content of the second component, passes through a maximum, and then decreases again. This behavior of the contact angle does not depend on the basicity or acidity of the oxide added, the type of phase diagram of the oxide system, or the ratio of the free energies of formation of the oxides. The surface energy of the interface oxide melt–refractory metal is in the range 1800–2500 MJ/m^2 and has a maximum at a second oxide content of 10 to 20 wt %. When Nb is wetted by melts of the system Al_2O_3–Nb_2O_5, the contact angle of wetting also passes through a maximum as the Nb_2O_5 content increases. (auth)

17387 HARDNESS AND PHASE DISPERSION OF LOW-ALLOY URANIUM CONTAINING Zr, Nb, Mo, AND Al. Lyutina, E. M.; Gomozov, L. I.; Ivanov, O. S. pp 92-97 of Stroenie i Svoistva Splavov Dlya Atomnoi Energetiki. Razdel I. Moscow; Atomizdat (1973). (In Russian).

A study was made of the effect of small additions of Zr, Nb, Mo, and Al on the hardness of uranium at 20°C. A comparison of phase dispersion was carried out in uranium alloys containing these elements after various thermal treatments. It is shown that in low-alloy uranium the tendency of separated phases to coagulate at 550°C increases in the order: U–Nb, U–Zr and U–Mo, that is, with decreasing melting point of the phases or of the gamma-solid solutions from which these phases are formed. After annealing at 550°C for 240 hours, the alloy hardness correlates with the content of dispersed phase. The maximum hardness (300 to 320 kg/mm^2) is attained in U–Nb–Mo and U–Nb–Al alloys at an additive content of 0.8 to 2 at. %. The phenomenon of a homogeneous separation of dispersed phase in high-purity uranium leads to an increase in dispersion of the separated phase and an increase in hardness to 400 kg/mm^2. (SJR)

17388 CREEP RESISTANCE OF LOW-ALLOY URANIUM CONTAINING ZIRCONIUM, NIOBIUM, MOLYBDENUM, AND ALUMINUM. Gomozov, L. I.; Lyutina, E. M.; Ivanov, O. S. pp 103-111 of Stroenie i Svoistva Splavov Dlya Atomnoi Energetiki. Razdel I. Moscow; Atomizdat (1973). (In Russian).

A study was made of the effect of small additions of Zr, Nb, Mo, and Al on the uranium creep rate that is established as a function of the mode of thermal treatment and composition of the starting uranium. Tests on the creep during bending were carried out at temperatures of 500, 550, 600, 630, and 650°C. It is shown that the established creep rate is decreased by an order of magnitude at 500°C and by three order of magnitude at 600°C on introducing ~0.2 at. % Zr, Nb, or Mo into the uranium. In commercial uranium alloys the maximum strengthening by carbide-forming elements (zirconium and niobium) at 0.2 to 0.4 at. % addition was caused by the separation of dispersed zirconium or niobium carbides during annealing because of an exchange reaction with UC which is formed during nonequilibrium crystallization. The amount of dispersion strengthening for successive alloys increases in the following order: U–Mo; U–Zr; U–Nb; U–Zr–Nb; U–Nb–Mo; and U–Nb–Al. Quenching of uranium alloys which tend to stabilization of the beta phase leads to the accumulation of defects during the beta → alpha transition, which increase the creep rate. A microstructural study of samples subjected to creep during elongation (600°C) to destruction showed that in alloys with a dispersed phase the low-temperature deformation processes are shifted to a region of higher temperatures. (SJR)

17389 GRAIN SIZE OF LOW-ALLOY URANIUM CONTAINING Zr, Nb, Mo, AND Al. Lyutina, E. M.; Gomozov, L. I.; Ivanov, O. S. pp 86-91 of Stroenie i Svoistva Splavov Dlya Atomnoi Energetiki. Razdel I. Moscow; Atomizdat (1973). (In Russian).

A study was made of the effect of composition and mode of thermal treatment on the grain size of the alpha phase in low-alloy uranium containing Zr, Nb, Mo, and Al. It is shown that an increase in rate of cooling from the delta-phase from 1 to 200°C per sec significantly decreases the grain size of the alpha phase in U–Zr, U–Nb and U–Mo uranium alloys containing 0.6, 1.3, and 2 at. % alloying element respectively and electrolytic uranium metal. With the use of technical grade uranium, an additional decrease in grain size can be observed on introducing ~2 at. % Zr, Nb, or Mo, as compared with the effect of the impurities alone. For ternary alloys of U–Nb–Mo, the grain size of the alpha phase is close to the additive values. For the alloys U–Zr–Nb and U–Nb–Al the grain size is significantly below the additive value. The smallest grain size is attained in the U–Nb–Al system. The alloy grain possesses a high stability on annealing in the upper region of the existence of the alpha phase. (SJR)

17390 COMPARATIVE STUDY OF SOME CREEP-RUPTURE EXTRAPOLATING FORMULAE. Murty, J. S. Acta Tech. Acad. Sci. Hung.; 76: No. 3, 293-306(1974).

It is demonstrated that the fundamental differences between the parametric formulae lie in the rate-controlling mechanisms which differ for the various formulae and reflect the assumptions made by various authors when deriving their formulae. Using the creep-rupture data of a Cr–Mo–V steel, the formulae are compared for their ability of being extrapolated by the standard deviation. It is found that the iso-thermal relations generally are in better agreement with the rupture data. All the parametric formulae which have been considered yielded standard deviations of the same order of magnitude. Rupture stresses were predicted for rupture times of 10^4 and 10^5 h by the various methods. (Hung. Tech. Abstr.)

17391 CONTACT MELTING IN BINARY SYSTEMS FORMING INTERMETALLICS. Khairulaev, M. R.; Patskhverova, L. S.; Savitsev, P. A. Fiz. Khim. Obrab. Mater.; No. 5, 158-161(1974). (In Russian).

Studies on contact melting in the systems Cd–Sb, Cu–Sb, Cu–Te, and Cu–Be showed that with increasing temperature the electrical conductivity of the components gradually decreases but sharply increases when a liquid phase appears. Thus the precise melting point can be determined. With rapid heating, contact meeting occurred 10°C below the temperature of the lowest eutectic. (tr-auth)

17392 HIGH-TEMPERATURE ALLOYS BASED ON TITANIUM AND IRON. Brandis, H.; von den Steinen, A.; Weigand, H. H.; Schubert, F. (Deutsche Edelstahlwerke GmbH, Krefeld, Ger.). pp 23-46 of High-Temperature Materials in Gas Turbines. Amsterdam; Elsevier Scientific Publishing Company (1974).

From third conference on high-temperature materials in gas turbines; Baden, Switzerland (12 Mar 1973).

The state of development of titanium alloys is reviewed, taking into account alloys which are suited for high-temperature applications. It is pointed out that the problem of surface protection against oxidation must be solved for titanium alloys which are to be subjected for long periods of time to temperatures above 590°C. Iron alloys considered include 12% chromium steels, austenitic steels, and gamma-prime-strengthened austenitic steels. It is found that a considerable increase in the hot strength and creep strength in the middle temperature range can be achieved by the addition of titanium and/or aluminum and/or niobium to iron alloys containing more than 20 wt % Ni. (IAA)

17393 FIELD EMISSION OF TANTALUM COATED WITH THIN FILMS OF SILICON MONOXIDE AND ALUMINA. Bobev, K.; Mireva, Z. Izv. Inst. Elektron., Bulg. Akad. Nauk.; 7: 11-17 (1974). (In Bulgarian).

The field-emission characteristics of Ta single crystals were studied before and after coating their surfaces with thin films of SiO and/or Al_2O_3. The incremental emission associated with the additives was analyzed by a probe technique, and the corresponding work functions were determined as functions of the nature and thickness of the surface film. For a degree of coverage less than 0.7, the dielectric films constitute an extra potential barrier through which electrons emerging from the metal have to penetrate. The height of this barrier remains fairly constant; its width depends on the nature of the film and the film thickness. (Metals Abstr)

17394 SEGREGATION OF ALLOYING ELEMENTS IN TERNARY NICKEL ALLOYS WITH ORIENTED STRUCTURE. Sittner, M.; Tuma, H. Kovove Mater.; 12: No. 2, 176-187(1974). (In German).

The effect of Si on the segregation of Co and Nb in Ni was studied in the alloys Ni–5Co–0.5Si, Ni–5Co–1Si, Ni–5Co–3Si, Ni–5Nb–0.5Si, Ni–5Nb–1Si, and Ni–5Nb–3Si with oriented structure. This structure was obtained by casting on a cooled Cu substrate. The microsegregation was measured from the concentration ratio in the dendrite middle regions and the average concentration of the element in the alloy. The segregation coefficient determined by point analysis were tabulated. The dependence of these coefficients was the same for oriented and nonoriented structures. Si has no effect on Nb segregation. Co is concentrated in the center of the crystal in the presence of Si. (Metals Abstr)

17395 STRUCTURE AND CHARACTERISTICS OF UNIDIRECTIONALLY SOLIDIFIED Ni–Ni_3Ta EUTECTIC. Bassi, A.; Wenger, D.; Dejace, J.; Matera, R. Kovove Mater.; 12: No. 2, 165-175(1974).

The metallographic and crystallographic structure of Ni–Ni_3Ta and the mechanism of tensile deformation at room and elevated temperature were studied. The samples were prepared from 99.99% pure elements by directional solidification of melt by withdrawing the crucible from the furnace through a water spray. The temperature gradients were 100–170° C/cm, and solidification rates were 0.5–66 cm/h. Powder x-ray diffraction and tensile tests were carried out. For metallographic studies, etched samples from oriented eutectic were made by three etchants. Their compositions are tabulated. Photos of grain boundary, Widmanstaetten precipitates, twins, subgrains in matrix, and lamellae are shown. Stress/strain curves were plotted at 20, 800, and 900°C. The microstructure is lamellar or fibrous, Ni_3Ta being the strengthening phase. Lattice parameters of the Ni_3Ta orthorhombic phase were determined. (Metals Abstr.)

17396 FI S 145: A NEW NICKEL PRECISION-CASTING ALLOY FOR USE AT HIGH TEMPERATURES IN AERO-ENGINES. Schubert, F. Dew Tech. Ber.; 13: No. 3, 164-170(Dec 1973). (In German).

Constitutional aspects of the alloys are considered with special reference to the proportion and properties of the γ'-phase present in the alloys. W and Mo are regarded as strengthening additions in the solid solution and Ta, Nb, and Hf as strengthening additions for the γ'-phase under creep conditions. Stability of the γ'-phase is discussed in relation to atomic concentrations and lattice constants of the added elements, and the results of creep and stress–rupture tests at 900 to 1050°C are represented in diagrams. The 0.2% PS, UTS at 750 to 1100°C, and the influence of different pretreatments on stress rupture at high temperature and on fracture at normal temperature are also indicated. An alloy having the nominal composition C 0.12, Co 10, Cr 7.7, W 13.5, Al 5.3, Ta + B + Zr + Hf 5%, balance Ni has creep rupture strengths beyond those of commonly used cast Ni-base alloys. (Metals Abstr.)

17397 PROPERTIES AND FRACTURE BEHAVIOR OF ALUMINUM STEEL WIRE COMPOSITES. Friedrich, E.; Mueller, K.; Pompe, W.; Foerster, W. (Kovove Mater.; 12: No. 2, 193-204 (1974). (In German).

Preparation conditions of Al strengthened by steel fibers were described. The growth of brittle diffusion layers and the changes of mechanical properties were studied with reference to their dependence on structure. Wires of 100 μm dia of Mo maraging-type steel containing Mo 14%, Co 18%, and Ni 8% were used. By one method the wires were dipped into molten Al, while by an alternative method, steel and Al wires were stranded together and sintered. The bond between the steel wire and Al matrix was tested by cyclic temperature variations from annealing to quenching into water. The growth of intermetallic layer was measured as a function of sintering pressure and temperature. Tensile strength and stress distribution in the boundary layer were discussed and compared with theory. (Metals Abstr.)

17398 FRACTURE SURFACES OF COPPER/TUNGSTEN FIBRE COMPOSITES. Taborskii, L.; Havalda, A.; Ivan, J.; Schichor, R.; Sebo, P. Kovove Mater.; 12: No. 2, 243-250 (1974). (In Slovak).

Composite materials of two types were prepared by diffusion bonding in vacuum. W fibers, 0.2 mm dia and strength 297 kp/mm^2, were either bonded with electrochemical Cu deposit, or Cu foils were added and W foils were bonded with these with electrochemically deposited Cu. Multi-layer samples were prepared with max 36% fiber volume. Tension tests were carried out at room temperature and at temperatures up to 300°C. Fracture surfaces were studied with an electron microscope. Improved diffusion bonding was obtained for the material without foils. Slip-type failure was revealed. Thinning of W fibers in the matrix was observed. The critical length was determined below which the fibers are pulled out from the matrix. (Metals Abstr.)

17399 SUPERPLASTIC DEFORMATION OF BERYLLIUM. Ivanov, V. E.; Tikhinskii, G. F.; Papirov, I. I.; Karpov, E. S.; Kapcherin, A. S. (Physical-Technical Inst., Kharkov). Dokl. Akad. Nauk SSSR; 216: No. 6, 1258-1260(21 Jun 1974). (In Russian).

The conditions for the realization of the superplastic deformation of Be were determined and characteristics of Be with this structure were measured. It was established that superplasticity does not occur in a wide temperature interval and deformation rate. The greatest increase of the specific expansion of the polycrystalline metal can be obtained by reduction of the grain size to less than 10μ or by increase of their growth rate while maintaining the mechanism controlling the plastic structure. (JSR)

17400 PRESSURE DEPENDENCE OF THE CRITICAL MAGNETIC FIELD OF SUPERCONDUCTING LEAD. Alterovitz, S.; Mapother, D.E. (Physics Department and Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801). Phys. Rev. B 11: No. 1, 139-144 (1 Jan 1975).

The pressure dependence of the critical magnetic field of lead has been measured in the range 0.3–4.2 K. The measurements were done using hydrostatic pressures up to 3 kbar. The pressure derivatives of H_0 and γ^* are reported, where H_0 is the extrapolated critical magnetic field at 0 K and $\gamma^* = \gamma/V$, where γ is the temperature coefficient of the normal electronic specific heat and V is the molar volume. $\partial \ln H_0/\partial \ln V = 4.77 \pm 0.12$ and $\partial \ln\gamma^*/\partial \ln V = 3.6 \pm 0.4$. The shape of the experimental deviation function $D(t) = h-(1-t^2)$, where $h = H/H_0$ and $t = T/T_c$, is shown to change under pressure, in agreement with the strong-coupling theory of superconducting lead under pressure. (auth)

17401 AMORPHOUS SUPERCONDUCTING LANTHANUM–GOLD ALLOYS OBTAINED BY LIQUID QUENCHING. Johnson, W.L.; Poon, S.J.; Duwez, P. (W. M. Keck Laboratory of Engineering Materials, California Institute of Technology, Pasadena, California 91109). Phys. Rev. B 11: No. 1, 150-154 (1 Jan 1975).

Results of x-ray diffraction, electrical resistivity, and critical magnetic field measurements are presented for amorphous superconducting lanthanum–gold alloys obtained by liquid quenching. The transition temperature of the alloys is ~3.5 °K. The bulk nature of the samples along with the stability of the amorphous phase at room temperature make this an ideal system for the study of superconductivity in the amorphous state. Estimates of intrinsic parameters including the coherence length ξ and penetration depth λ are presented and discussed. The observed linearity of $H_{c2}(T)$ and its extrapolated low-temperature limiting value are discussed and compared to predicted behavior for $H_{c2}(T)$. (auth)

17402 THEORY OF MAGNETIC PROPERTIES OF HEAVY RARE–EARTH METALS: TEMPERATURE DEPENDENCE OF MAGNETIZATION, ANISOTROPY, AND RESONANCE ENERGY. Lindgård, P.; Danielsen, O. (Danish Atomic Energy Commission, Research Establishment Risö, DK–4000 Roskilde, Denmark). Phys. Rev. B 11: No. 1, 351-362 (1 Jan 1975).

The contributions to the macroscopic-anisotropy constants and resonance energy from crystal-field anisotropy, magnetoelastic effects in the frozen and flexible lattice model, and two-ion interactions have been found for all terms allowed in a crystal of hexagonal symmetry. The temperature dependence is expressed as expansions of thermal averages of the Stevens operators $\langle O^m_l \rangle$. A systematic spin-wave theory, renormalized in the Hartree–Fock approximation, is developed and used to find the temperature dependence of the Stevens operators and the resonance energy in terms of the magnetization-deviation parameter $\Delta M(T)$ and the parameter $b(T)$, which characterizes the nonsphericity of the moment precession. Significant deviations from the classical $l(l+1)/2$ temperature law are found. The inclusion of $b(T)$ gives rise to important reinterpretations of the contributions to the resonance energy. Numerical results are given for the magnetization agreeing with experiment for Gd, Tb, and Dy. For Tb and Dy the zero-point deviations were found to be $0.05\mu_B$ and $0.08\mu_B$, respectively, and the ratio $[b(T) - b(0)]/[\Delta M(T) - \Delta M(0)]$ is approximately 1/3 for all temperatures below 100 K. This gives rise to large corrections of the results of previous theories. Tables of these corrections are given for the resonance energy and the macroscopic-anisotropy constants. For planar anisotropy the temperature renormalization is reduced for the axial anisotropy and increased for the in-plane anisotropy. (auth)

17403 ANISOTROPY OF THE PENETRATION DEPTH IN SUPERCONDUCTING TIN. Tai, P.C.L.; Beasley, M.R.; Tinkham, M. (Physics Department and Division of Engineering and Applied Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. B 11: No. 1, 411-419 (1 Jan 1975).

The temperature dependence and anisotropy of the penetration depth $\lambda(T)$ in superconducting tin was measured using a superconducting magnetometer. Single bulk crystals of tin were used as samples to measure the anisotopy with respect to crystallographic orientations. Considerable anisotropy was found with respect to $\hat{j}$, the shielding-current direction, and $\hat{n}$, the direction of the normal to the sample plane surfaces. These data are compared to a simple theory of nonlocal anisotropy. They are also fitted to the BCS theory by varying parameters. (auth)

17404 MAGNETIC PROPERTIES OF NEPTUNIUM LAVES PHASES: $NpMn_2$, $NpFe_2$, $NpCo_2$, AND $NpNi_2$. Aldred, A.T.; Dunlap, B.D.; Lam, D.J.; Lander, G.H.; Mueller, M.H.; Nowik, I. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. B 11: No. 1, 530-544 (1 Jan 1975).

The magnetic properties of the cubic Laves phases (C–15 structure) $NpMn_2$, $NpFe_2$, $NpCo_2$, and $NpNi_2$ have been studied from 4 to 300 K by means of magnetization, neutron-diffraction, and nuclear-γ-ray resonance (Mössbauer) experiments. The respective ordering temperatures (and types of ordering) are 18 K (ferro), ~500 K (ferro), 15 K (antiferro), and 32 K (ferro). Magnetic moments are present on the neptunium atoms in all compounds with values varying from $1.2\mu_B$ in $NpNi_2$ to $0.3\mu_B$ in $NpMn_2$. On the transition-metal site, only the iron atom carries a magnetic moment in zero field; in high magnetic fields, a small moment of $\sim 0.2\mu_B$ is observed on the manganese atom. No simple correlation appears to exist among the values of the magnetic moments, the Np–Np distance, and the ordering temperature. A feature of the data is the large high-field susceptibility in the ferromagnetic compounds at low temperatures. Some magnetic properties, such as the large anisotropy ($\langle 111 \rangle$ is the easy axis) and the linear relationship between the hyperfine field and the neptunium magnetic moment, are best interpreted in terms of localized $5f$ electrons on the actinide ion, whereas other properties, such as the low values of the neptunium moments and the high-field susceptibility, suggest strong hybridization between the $5f$ and $3d$ electrons. (auth)

17405 CRYSTAL FIELDS AND EXCHANGE IN DILUTE ALLOYS OF Tb, Dy, AND Er IN Y STUDIED FOR DIFFERENT CONCENTRATIONS. Høg, J.; Touborg, P. (Department of Electrophysics, Technical University, 2800 Lyngby, Denmark). Phys. Rev. B 11: No. 1, 520-529 (1 Jan 1975).

This is a sequel to an earlier paper reporting magnetization measurements on Y–0.14–at. %–Dy and Y–0.14–at. %–Er. In the present paper we have performed similar measurements on different concentrations of dilute Er, Dy, and Tb alloys and also included specific measurements of the basal-plane anisotropy. Crystal-field and exchange parameters were obtained by fits to the inverse initial susceptibility. The anisotropy measurements provide a confirmation of the crystal-field parameters in Dy and Er and are used to deduce B_{66} in Tb. The measurements on different concentrations confirm the adequacy of the theoretical models used. The crystal-field parameters vary substantially with the solute. The molecular-field tensors are highly anisotropic and are approximately independent of concentration at small concentrations. (auth)

17406 PROPAGATING ORDER–PARAMETER COLLECTIVE MODES IN SUPERCONDUCTING FILMS. Carlson, R.V.; Goldman, A.M. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). Phys. Rev. Lett. 34: No. 1, 11-15 (6 Jan 1975).

A peak at finite frequency has been observed in measurements of the order-parameter dynamical structure factor of short-mean-free-path superconducting aluminum films. The existence of a propagating, low-frequency order-parameter collective mode can be inferred from these results. (auth)

17407 PRESSURE–ENHANCED LATTICE TRANSFORMATION IN Nb_3Sn SINGLE CRYSTAL. Chu, C.W. (Department of Physics, Cleveland State University, Cleveland, Ohio 44115). Phys. Rev. Lett. 33: No. 21, 1283-1286 (18 Nov 1974).

We report the first observation of pressure-enhanced lattice transformation in the high-temperature superconductor Nb_3Sn. The opposite pressure effects on the lattice transformation and the superconducting transition in A15 compounds can thus be understood on the basis of the Weger–Labbé–Friedel model by taking into account the pressure-induced interband charge transfer. (auth)

17408 ELECTRONIC PROPERTIES OF BERYLLIDES OF THE RARE EARTHS AND SOME ACTINIDES. Bucher, E.; Maita, J.P.; Hull, G.W.; Fulton, R.C.; Cooper, A.S. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. B 11: No. 1, 440-449 (1 Jan 1975).

A magnetic study has been conducted of 17 beryllides of the form MBe_{13}, M being a rare earth, Th, U, and an alloy $La_{0.75}Tm_{0.25}$. Specific-heat studies were also made for M = La, Pr, Sm, Tm, Lu, Th, and U. A thorough crystal-field analysis is presented for $PrBe_{13}$, $TmBe_{13}$, both ions being in a crystal-field singlet ground state, and the expected nuclear cooling and ordering behavior is also thoroughly discussed. (auth)

17409 COMMENT ON "OBSERVATIONS OF THERMAL FLUCTUATIONS IN SUPERCONDUCTING MICROBRIDGES". Lukens, J.E. (Department of Physics, State University of New York at Stony Brook, Stony Brook, New York 11790); Webb, W.W. Phys. Rev. Lett. 33: No. 26, 1586-1587 (23 Dec 1974).

The interesting switching phenomena recently reported by Rachford et al. to occur at the onset of certain puzzling current- and temperature-dependent steps in superconducting microbridges should be considered a phenomenon yet to be explained rather than a case to which existing theory of thermally activated phase slips is directly applicable. (auth)

17410 INTRABAND LUMINESCENCE AND ABSORPTION OF INFRARED RADIATION IN n–TYPE InAs SUBJECTED TO STRONG ELECTRIC FIELDS. Vorob'ev, L.E. (M. I. Kalinin Leningrad Polytechnic Institute). Sov. Phys.–Semicond. 8: No. 7, 839-843 (Jan 1975).

A study was made of the infrared luminescence ($\lambda = 8-22\ \mu$) emitted from n-type InAs in strong electric fields. This luminescence was due to the emission of photons by hot electrons with the assistance of longitudinal optical (LO) phonons. A comparison of the calculated and experimental luminescence spectra yielded the hot electron temperature T_e at high electron energies. In a field of 750 V/cm the temperature T_e decreased from 360 to 290°K with increasing photon energy and in a field of 430 V/cm this temperature decreased from 200 to 180°K. It was found that at $T_0=80$°K in the range of electron densities $N_e>10^{16}$ cm^{-3} the accumulation of nonequilibrium LO photons reduced considerably the energy lost by hot electrons and increased strongly the absorption coefficient of free hot carriers. (auth)

17411 ELABORATION OF METHODS FOR INVESTIGATION INTO SOME URANIUM ALLOYS AFFECTED BY CREEP IN γ-REGION. Gomozov, L. I.; Makhova, V. A. pp 99-103 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

By the use of the alloy U + 7.5 at. % Nb + 7.5 at. % Mo, a method was developed for the development of the dislocation structure of γ-alloys of U. The cooling of the alloys must proceed at a rate guaranteeing the rearrangement of the dislocations in the alloy characterized by the heterogeneous mechanism of the transformation of the γ phase. The optimum etching regime is first the electrolytic polishing in the reagent composed of 2 g CrO_3 + 200 ml H_3PO_4 + 50 ml H_2O at a voltage pulse of 30 V, followed by electrolytic etching in a 5M solution of citric acid in a bath temperature of 10 to 20°C at a voltage of 5 V for 3 min. The study of the dislocation structure showed that in the one-phase γ alloys of U the resistance to deformation of the limiting zone is the most important factor controlling the creep. Adaptation of the grain during slippage occurs by formation of subgrains leading to a blurring of the wide-angle boundary. (tr-auth)

17412 POLYTHERMAL SECTIONS AND DECOMPOSITION KINETICS OF THE γ-PHASE IN U−Zr−Ti AND U−Nb−Ti ALLOY SYSTEMS CONTAINING 85 AT. % URANIUM. Gomozov, L. I.; Makhova, V. A.; Voronov, N. I. pp 80-84 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

3 Figs., 9 refs.

By thermal and dilatometric analyses and from microstructural measurements, the solidus and liquidus temperatures and the temperatures for the transformation of the alloys into the solid state were determined. The polythermal sections at 85 at. % U were constructed for the U−Zr−Ti and U−Nb−Ti systems. The fusion temperatures, particularly for the U−Nb−Ti system, were higher than additive. The rate of isothermal decomposition of the U−Ti alloys was an order of magnitude higher than for U−Nb alloys which is related both to the high supercooling and to the relative proximity of the precipitating phases to the composition of the γ solid solution for U−Ti alloys. U−Zr−Ti and U−Nb−Ti alloys, unlike U−Nb alloys, are decomposed structurally homogeneously. (tr-auth)

17413 KINETICS OF ISOTHERMAL DECOMPOSITION OF γ-SOLID SOLUTION IN URANIUM−ZIRCONIUM−NIOBIUM ALLOYS. Kishenevskij, V. B.; Sofronova, R. M.; Ivanov, O. S. pp 74-80 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

4 Figs., 1 table, 9 refs.

The diagrams of isothermal transformation were constructed for two U alloys containing 15 at. % Zr + 5 at. % Nb and 10 at. % Zr and 10 at. % Nb. The construction of the quartz dilatometer with automatic recording of the expansion of the sample was described. The possibility of taking into consideration the experimental errors caused by the extended stay of the samples between the temperatures of the γ state and the isothermal holding time was shown. The change of the kinetics of the decay of the γ phase in U alloys with 20% (Zr + Nb) was analyzed as a function of the ratio of alloying elements. (tr-atuh)

17414 METASTABLE URANIUM BASE PHASES IN THE U−Ti- AND U−Ti−Mo SYSTEMS. Kushnir, N. P.; Sofronova, R. M.; Ivanov, O. S. pp 70-73 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

2 Figs., 1 table, 7 refs.

During quenching from the γ region in alloys of the U−Ti and U−Ti−Mo systems the metastable phases α', α'', γ^0 and the two-phase mixture $\alpha'' + \gamma^0$ ($\alpha'' + \gamma$) are formed. In the Ti-rich region of the alloy abnormal compression of the β parameter of the α' and α'' phase and deviation of the pattern of the boundary of the metastable phase region to the additive were observed. A decrease of the cooling rate causes a very extensive transformation $\gamma \rightarrow \alpha'$ in alloys with a high Ti concentration and inhibits it in alloys from regions next to the U−Mo side. (tr-auth)

17415 DURABLE HOT HARDNESS OF URANIUM ALLOYS CONTAINING 15 AT. % NIOBIUM AND MOLYBDENUM. Makhova, V. A.; Gomozov, L. I. pp 97-99 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

2 Figs., 1 table, 9 refs.

The durable hot hardness of U alloys with 15 at. % Nb and Mo was studied. The test temperatures were 700, 800, and 900°C. The duration of the stress was 1.3 and 10 min. The concentration dependence of the creep rate during tests on the durable hot hardness, expressed by the relation $V_H = 1/H(dH/d\tau) = n/\tau_h$ where n is the exponent in the Shishchokin formula, and τ_h is the time for reaching a given value of hardness, in general compares the change of hardness. The creep activation energy Q was calculated from the relation $V_H \sim \exp(-Q/RT)$. This energy is significantly higher than the activation energy of self-diffusion for α−U and relatively low-alloyed alloys. It was noted that the creep activation energy during expansion of alloys with at. % Nb : at. % Mo ratio equal to 1 : 1, obtained by the method of cyclic increase of temperature, is close to the activation energy obtained by the method of durable hot hardness. (tr-auth)

17416 PHASE DIAGRAM OF THE NIOBIUM−TITANIUM−HAFNIUM SYSTEM. Raevskij, I. I.; Stepanov, N. V.; Ivanov, O. S. pp 143-148 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 2. Zirconium-, Niobium- and Vanadium Alloys as Structural Materials of Various Purposes. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

4 Figs., 1 table, 11 refs.

The phase diagram of the Nb−Ti−Hf system was constructed from x-ray structural and x-ray phase analyses. The location of the $\beta/\alpha_{Hf} + \beta$ boundary in the Nb−Hf system was defined more precisely in the temperature region from 1050 to 500°C in cases when electron-beam Nb and iodide Hf are used for the mixture and the alloys were prepared by the arc-fusion method. The isothermal cross section of the Hb−Ti−Hf system was determined at 1050, 700, 600, and 500°C. All these isothermal cross sections contain three regions: β, α_{Hf-Ti}, and $\alpha_{Hf-Ti} + \beta$. (tr-auth)

17417 SINGLE-PHASE AND DIPHASE METASTABLE STATES FORMED DURING QUENCHING OF THE U−Zr−Re AND U−Ru−Mo ALLOY SYSTEMS. Sofronova, R. M.; Kushnir, N. P.; Ivanov, O. S. pp 59-63 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

2 Figs., 4 tables, 9 refs.

The characteristic feature of the non-equilibrium state in alloys of the U−Zr−Re and U−Ru−Mo systems is the formation of two-phase regions of the metastable phase of the α−U and γ−U type. Its dimension increases during substitution of the Re by Zr and of Mo by Ru. A decrease of the cooling rate during quenching promotes an extreme development of the transformation of the γ phase into the α' phase through the intermediate states $\gamma^s \rightarrow \gamma^0 \rightarrow \alpha''$ at all concentration intervals of ~5 to 15 at. % addition to U. It also leads to convergence of the structure of the coexistent phases. It was assumed that two phases are fixed by quenching the γ solid solution in which the tendency to the formation of chemical compounds causes regions locally rich and impoverished in the alloying element. (tr-auth)

17418 THE DEVELOPMENT OF $\gamma \rightarrow \gamma^s \rightarrow \gamma^0 \rightarrow \alpha'' \rightarrow \alpha'$ TRANSFORMATION IN QUENCH-HARDENED URANIUM ALLOYS UNDER THE ACTION OF PLASTIC DEFORMATION. Sofronova, R. M.; Ivanov, O. S. pp 64-66 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

1 Fig., 8 refs.

Plastic deformations at room temperature in quenched U alloys promotes the development of the transformation $\gamma \rightarrow \gamma^s \rightarrow \gamma^0 \rightarrow \alpha'' \rightarrow \alpha'$. The pseudocubic phase γ^s undergoes tetragonalization. The tetragonal γ^0 phase decreases the ratio c/a. The monoclinic α'' with increase of the degree of deformation decreases the angle of monoclinicity. Deformation with variation of the crystal structure proceeds by the same slip system as the displacement transformation $\gamma \rightarrow \alpha'$ and $\gamma \rightarrow \gamma^0$, i.e., by $\{112\}_\gamma \langle 111\rangle_\gamma$ and its equivalent $\{010\}_\alpha \langle 100\rangle_\alpha$ and by $\{110\}_\gamma \langle 111\rangle_\gamma$ and its equivalent $\{110\}_\alpha \langle 110\rangle_\alpha$. These systems are systems with very easy slip in the α−U lattice at normal and increased temperature and in the bcc lattice. (tr-auth)

17419 METASTABLE URANIUM BASE PHASES IN THE U−Zr−Mo AND U−Zr−Nb TERNARY ALLOY SYSTEMS AND SOME PECULIARITIES OF $\gamma^0 \rightarrow \alpha''$ TRANSFORMATION.

Sofronova, R. M.; Kushnir, N. P.; Ivanov, O. S. pp 53-59 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

8 Figs., 2 tables, 13 refs.

In U alloys with 15 to 20 at. % (Zr + Mo) and 20 to 30 at. % (Zr + Nb), quenched in water from the γ region, a complete series of metastable phases α', α'', γ^0, $\gamma^3(\gamma)$ were formed with change of the relative concentrations of Zr and Mo and Zr and Nb. A decrease of the cooling rate inhibits the transformation in Mo and Nb rich regions in the binary U–Mo and U–Nb systems but stimulates the transformation in Zr-rich regions. The γ^0 and α'' phases, having stages passing successively through the lattice of the U alloy during the quenching process, have a more contiguous structure than in the binary alloys. The degree of tetragonality of the γ^0 phase directly at the $\gamma^0 \rightarrow \alpha''$ transition point is shown by the ratio of the parameters of the pseudocell type of γ–U, which is $c/a \cong 0.9$. The high angle of monoclinicity at the γ^0/α'' boundary $\cong 95°$. (tr-auth)

17420 THE EFFECT OF LOW-TEMPERATURE TEMPERING (100 TO 300°C) ON THE CRYSTAL STRUCTURE OF URANIUM METASTABLE PHASES. Sofronova, R. M.; Kushnir, N. P.; Gerasimova, I. G.; Ivanov, O. S. pp 66–69 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

1 Fig., 1 table, 4 refs.

U-based metastable phases formed during quenching of binary and ternary alloys with Mo, Nb, and Zr were annealed in a regime of 100°C for 13 hrs, 200°C for 4 hrs, and 300°C for 3 hrs. The annealing temperatures were sufficiently low to prevent the decomposition of the supersaturated solid solution with structure of the α', α'', γ^0, γ^s, and γ phases but sufficiently high to cause the change of the crystal structure of the phases in a more extensive fashion than during quenching. The alloys rich in Mo have a greater tendency during annealing to the reverse transformation $\alpha' \rightarrow \alpha'' \rightarrow \gamma^0$. Alloys with Nb have a somewhat smaller tendency and ternary alloys alloyed primarily with Zr undergo a very extensive direct transformation $\gamma \rightarrow \alpha'$. (tr-auth)

17421 INVESTIGATION INTO TEMPERING EFFECT AT 300 TO 600°C ON STRUCTURE AND PROPERTIES OF ZIRCONIUM ALLOYS CONTAINING 2.5% Nb. Tararaeva, E. M.; Alekseenko, G. K.; Utesheva, Z. A.; Ivanov, O. S. pp 162–169 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 2. Zirconium-, Niobium- and Vanadium Alloys as Structural Materials of Various Purposes. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

5 Figs, 8 refs.

A study was made of the effect of tempering at 300 to 600°C on the physical-mechanical properties of Zr alloys with 2.5% Nb cold deformed to 70% reduction. The measurement of the electric resistance, critical temperature for transition to the superconducting state, tensile strength, relative expansion and contraction during tension tests, impact strength of the cold-deformed alloy and after annealing was accompanied by electron microscopic and x-ray methods. It was established that at each temperature at least two processes occur caused by the tempering: growth and aging at 300 to 400°C and recrystallization and aging at 500 to 600°C. (tr-auth)

17422 PHASE EQUILIBRIUM IN THE UC–UWC$_2$–W–U REGION OF THE U–W–C TERNARY SYSTEM. Alekseeva, Z. M.; Ivanov, O. S. pp 13-16 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

1 Ref., 3 figs.

On the basis of x-ray phase and microstructure analyses of cast and annealed alloys in the UC–UWC$_2$–W–U region a projection of the phase diagram in this region was constructed. The phase diagram explains the appearance of the UWC$_{2-x}$ carbide in the cast alloys of the UC–W cross section. (tr-auth)

17423 DETAILED IMPROVEMENT OF PHASE DIAGRAM OF THE ZIRCONIUM–IRON–NICKEL SYSTEM. Tararaeva, E. M.; Ivanov, O. S. pp 131-138 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 2. Zirconium-, Niobium- and Vanadium Alloys as Structural Materials of Various Purposes. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

5 Figs., 3 refs.

The phase equilibria in the Zr–Zr$_2$Ni–ZrFe$_2$ system were determined by microscopic, x-ray, differential thermal, and local x-ray spectral analyses and by measurement of the hardness and microhardness. The data obtained showed that the compounds Zr$_2$Ni and ZrFe$_2$ form double systems of the electrical type. Between Zr$_2$Ni and Zr$_2$Fe of a two-phase system no equilibria were established. In the ternary system Zr–Zr$_2$Ni–ZrFe$_2$ there are four non-variant equilibria. (tr-auth)

17424 EQUILIBRIUM NATURE OF THE URANIUM-RICH PORTION IN THE U–Al–Si–Fe SYSTEM PHASE DIAGRAM. Badaeva, T. A.; Alekseenko, G. K.; Aleksandrova, L. N. pp 38–45 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

5 Figs., 1 table, 13 refs.

From microstructural and thermal analyses and by measurement of the microhardness, the character of the equilibrium in the U corner of the ternary system U–Al–Si–Fe was established. It was shown that in alloys rich in U there are peritectic non-variant equilibrium at ~ 790°C (heat + $\gamma \rightleftharpoons U_6Fe + U_3Si_2 + UAl_2$) and three equilibria in the solid state, peritectic non-variant equilibrium at ~ 785°C ($\gamma + U_3Si_2 \rightleftharpoons U_3Si + U_6Fe + UAl_2$), and two eutective non-variant equilibria at ~ 670°C and ~ 570°C ($\gamma \rightleftharpoons \beta + U_3Si + U_6Fe + UAl_2$ and $\beta \rightleftharpoons \alpha + U_3Si + U_6Fe + UAl_2$). In the low temperature region up to room temperature the U-based solid solution is in equilibrium with the phases UAl$_2$, U$_3$Si, and U$_6$Fe. (tr-auth)

17425 ALUMINIUM-, SILICON- AND IRON SOLUBILITY IN α-URANIUM. Badaeva, T. A.; Alekseenko, G. K.; Aleksandrova, L. N. pp 34–38 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

1 Fig., 3 tables, 8 refs.

From a metallographic analysis the solubility of Al, Si, and Fe in α–U was determined. It was shown that the solubility of Al in α–U at 600°C is less than 0.01 at. %, that of Si is less than 0.085 at. %, and that of Fe is less than 0.01 at. %. (tr-auth)

17426 MICROSTRUCTURAL PICTURE OF PRECIPITATIONS IN URANIUM ALLOYS WITH 1% (Al, Si, Fe) FOLLOWING DECOMPOSITION OF γ- AND β-SOLID SOLUTIONS. Badaeva, T. A.; Alekseenko, G. K.; Aleksandrova, L. N. pp 45-52 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian)

3 figs., 2 tables, 9 refs.

The microstructural picture of precipitations in binary, ternary, and quarternary U alloys with 1 at.% (Al, Si, Fe), quenched from 800 and 750°C followed by annealing at 600°C for 240 hrs, was studied. It was established that during alloying the alloys with Fe the phase U$_6$Fe is precipitated in the form of relatively coarse inclusions (~5 μ after quenching from 800° and annealing at 600°C and 10 to 20 μ after quenching from 750°C and annealing at 600°C). Quenching from 750°C with subsequent annealing at 600°C promoted the stabilization of the grain dimensions more than quenching from 800° and annealing at 600°C. (tr-auth)

17427 CONTRIBUTION TO THE PHASE DIAGRAM OF THE Th–Mn SYSTEM. Badaeva, T. A.; Aleksandrova, L. N. pp 26-30 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian)

3 figs., 2 refs., 1 table.

By thermal, x-ray, and microstructural analyses and by measurement of the hardness and microhardness, the phase diagram of the Th–Mn system was constructed in the concentration interval from 0 to 72 at. % Mn. It was shown that the α–Th based solid solution is in eutectic equilibrium with the ThMn$_2$ compound, formed by the peritectic reaction $Th_6Mn_{23} \rightleftharpoons ThMn_2$ at 1120°C. The eutectic point is ~39 at. % Mn at 950°C. α–Th based solid solution at 880°C contains only about 1 at. % Mn. (tr-auth)

17428 THERMODYNAMIC PROPERTIES AND PHASE DIAGRAM OF TERNARY SODIUM ALLOYS. II. Sodium + Lead + Indium. Neethling, A. J. (Atomic Energy Board, Pelindoba, Pretoria). J. Chem. Thermodyn.; 6: No. 11, 1083-1085(Nov 1974).

Electromotive force measurements in the temperature range 670 to 760°K were used to determine the thermodynamic properties of sodium in the ternary alloys sodium + lead + indium. The corresponding functions for lead and indium were calculated by Darken's method. The integral properties for the alloys are also tabulated. Thermal analysis was used to determine the solid + liquid equilibrium surface for the ternary system. (auth)

17429 OXYGEN- AND TIN EFFECT ON MECHANICAL AND CORROSION PROPERTIES OF ZIRCONIUM ALLOYS CONTAIN-

ING 1 AND 2.5 AT. % Nb. Tararaeva, E. M.; Murav'eva, L. S.; Ivanov, O. S. pp 158-162 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 2. Zirconium-, Niobium- and Vanadium Alloys as Structural Materials of Various Purposes. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian)

4 tables, 6 refs.

The study of the corrosion stability in water at 300° and in steam at 400° and 100 atm for 9000 hrs of Zr alloys with 1 and 2.5 at. % Nb, alloyed with Sn and O, showed that both at 300 and 400° the greatest stability was found in alloys with 1% Nb and 1% O. The study of the mechanical properties of the alloys in the original state during fracture tests showed that the maximum increase of the strength without significant reduction of the ductility was obtained by combined alloying of the 1 and 2.5 at. % Nb alloys with Sn and O. After corrosion in water at 300° an increase of the strength was observed with simultaneous increase of the relative expansion. Alloys with 1% Nb and 1% O have the optimum combination of mechanical and corrosion properties. (tr-auth)

17430 THERMOELECTRIC PROPERTIES OF BINARY V- AND Nb ALLOYS WITH -Ti, -Mo AND -W. Terekhov, G. I.; Al'tzitser, M. Ya.; Ivanov, O. S. pp 178-183 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 2. Zirconium-, Niobium- and Vanadium Alloys as Structural Materials of Various Purposes. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian)

7 figs, 6 refs.

The thermoelectric properties up to 1000° were studied for the binary solid solutions of V and Nb with Ti, Mo, and W. The direct correlation between the absolute thermo emf and the electron concentration, known for Ni-based solid solutions, was not observed for these solid solutions. The solid solutions of these systems have changes in the absolute thermo emf which are similar according to the groups of the periodic system. (tr-auth)

17431 THE REGION OF THE α''-PHASE EXISTENCE IN THE U–Nb–Mo SYSTEM. Terekhov, G. I.; Tagirova, R. Kh. pp 73-74 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian)

1 fig., 6 refs.

By x-radiographic analysis of alloys of the U–Nb–Mo system, quenched from the γ state, the boundaries of the region for the formation of the metastable α'' phase were established. The α'' phase region in the ternary system, in contrast to the additive changes, is expanded both in the direction of the U corner and to the Nb–Mo side. (tr-auth)

17432 PHASE EQUILIBRIUM IN THE $UC-UMoC_2-Mo_2C-Mo-U$ REGION OF THE U–Mo–C TERNARY SYSTEM. Alekseeva, Z. M.; Ivanov, O. S. pp 8-12 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian)

2 refs., 4 figs.

On the basis of x-ray phase and microstructure analyses of cast and annealed alloys in the $UC-UMoC_2-Mo_2C-Mo-U$ region, projections of the phase diagrams of this region of the ternary system U–Mo–C were constructed. The diagram explains the appearance of the $UMoC_{2-x}$ carbide in the cast alloys of the UC–Mo cross section. (tr-auth)

17433 THE NATURE OF BINARY CARBIDE WITH MONOCLINIC LATTICE IN THE U–Mo–C AND U–W–C SYSTEMS. Alekseeva, Z. M.; Ivanov, O. S. pp 5-8 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian)

10 refs., 2 figs.

Cast and high-temperature quenched alloys of the U : Mo = 1 : 1 and U : W = 1 : 1 cross section were studied by x-ray phase analysis. The nature of the $UMoC_{2-x}$ and UWC_{2-x} carbides was determined on the basis of this study. The $UMoC_{2-x}$ and UWC_{2-x} carbides are formed by the reaction heat + $UMeC_2 \rightleftharpoons UMeC_{2-x}$ at 2170 and 2330° for the Mo and W carbides respectively. The value of $x \cong 0.06$. (tr-auth)

17434 THERMOELECTRIC PROPERTIES OF Th–Y α-SOLID SOLUTION. Terekhov, G. I.; Tagirova, R. Kh.; Ivanov, O. S. pp 126-130 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

5 figs, 1 table, 9 refs.

By metallographic and x-radiographic analyses the solubility of Y in Th was determined as 42.5 at. % at 1000°C. Alloying Th with Y up to 60 at. % does not change the negative sign of the absolute thermo emf of Th from room temperature up to 1000°C and does not substantially affect its size. (tr-auth)

17435 THERMOELECTRIC PROPERTIES OF THE γ-SOLID SOLUTIONS OF THE U–Zr- AND U–Nb ALLOY SYSTEMS. Terekhov, G. I.; Sinyakova, S. I.; Ivanov, O. S. pp 118-125 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

7 figs, 17 refs.

The thermoelectric properties of γ solid solutions of the U–Zr and U–Nb systems were studied. The high values of the absolute thermo emf with a positive sign of the order of 32 to 34 μV/° were found in the U–Nb system in the concentration interval from 2.5 to 3.5 at. % Nb. Experimental data on the measurement of the thermo emf and the electric resistance showed that the Fermi surface is found in strong interaction with the boundaries of the Brillouin zone. An increase of the absolute thermo emf of γ–U during dissolution of Nb was explained by the decrease of the area of the Fermi surface. (tr-auth)

17436 CHARACTERISTIC TEMPERATURES OF SOME METASTABLE URANIUM γ-SOLID SOLUTIONS. Terekhov, G. I.; Tagirova, R. Kh.; Ivanov, O. S. pp 84-86 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 1. Uranium and Thorium Alloys as the Nuclear Fissile Fuel. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

1 table, 4 refs.

By measurement of the thermal factors of the scattering of x rays at the temperature of boiling nitrogen and room temperature, the characteristic temperatures of some γ solid solutions of U-based alloys with Zr, Nb, Mo, and Cr were determined. Comparative evaluations were made of the force of the interatomic bonds of these solid solutions as factors of the resistance to radiation destruction of the crystalline lattice. (tr-auth)

17437 STUDYING THE INITIAL STAGES OF DECOMPOSITION OF SOLID SOLUTIONS OF THE Zr–Nb- AND Ti–Nb ALLOY SYSTEMS IN COMPARISON WITH CHANGES IN THE CRITICAL TEMPERATURE OF TRANSITION INTO SUPERCONDUCTING STATE. Tararaeva, E. M.; Gajnov, V. N.; Ivanov, O. S.; Alekseevskij, N. E. pp 148-158 of Structure and Properties of Alloys for Nuclear Power Engineering. Section 2. Zirconium-, Niobium- and Vanadium Alloys as Structural Materials of Various Purposes. Moskow; Izdatel'stvo "Nauka" (1973). (In Russian).

3 figs, 3 tables, 6 refs.

The decomposition of the original β solid solution with formation of solid solutions having superconductivity at He temperature was established by measurement of T_c for Zr–Nb and Ti–Nb alloys. X-ray analysis at the same time was shown to be insensitive for many alloys. The data from the measurement of the T_c showed that in all alloys the decomposition of the original solid solution during annealing at 300 to 600°C for 30 min passes through intermediate stages. The existence of two T_c even in the cold-deformed state indicates the decay of the β solid solution occurring in the alloys, which can result from the hot deformation process or be caused by the presence of microinhomogeneities in the alloys. (tr-auth)

17438 LOW-PEARLITE LOW-ALLOYED STEEL CONTAINING VANADIUM AND NIOBIUM. Rudchanko, A. V.; Nasibov, A. G.; Litvinenko, O. A.; Golikov, I. N.; Klimashin, P. S. (Inst. of Ferrous Metallurgy, Moscow). Stal; No. 2, 160-163(Feb 1974). (In Russian).

The strength, plasticity, and viscosity of low-pearlite low-alloyed hot-rolled sheet steel 08G2SFB (manufactured commercially by the Novo-Lipetskii Metallurgical Works) were studied and compared with the properties of standard steel 17G2SF. With the recommended composition of the new steel (containing no more than 0.10% C, 1.45% Mn, 0.5% Si, 0.05% V, 0.04% Nb, 0.03% S, and 0.03% P) the following mechanical properties are ensured: $\sigma_B \geq 56$ kgf/cm^2, $\sigma_{0.2} \geq 44$ kgf/cm^2, $\delta_5 \geq 20\%$, and specific viscosity at –40 and –60°C no less than 5 and 4 kgf.m/cm^2, respectively. The greatest economic effect from the use of steel 08G2SFB is obtained in structures whose main calculated characteristic is yield point. (tr-auth)

17439 CONTACT FUSION IN THIN INDIUM–CADMIUM FILMS. Savintsev, K. A.; Getazheev, K. A.; Shidov, Kh. T. Uch. Zap., Kabardino-Balkar. Gos. Univ.; No. 39, 71-74(1972). (In Russian).

The effect of the film thickness of thin In–Cd films on the contact melting temperature, T_{KN}, and the electrical conductivity was studied. The films were obtained by vacuum evaporation and condensation on glass substrates (temperature 60°C) at rates for In and Cd of 0.5 and 10 Å/s, respectively. For these thin films T_{KN} is below that of massive specimens. A system of equations was derived relating the equilibrium temperature to the composition of the co-existing phases. Taking the free surface energy into account, an analysis of the data leads to a reduced temperature for the equilibrium phase, i.e. the phase diagram is moved downwards along the temperature axis. Thus, the eutectic temperature (agreeing with the T_{KN} value) for thin films will be lower than in the case of massive systems. There are noticeable differences between the theoretical and experimental data. (Referativnyi Zh.)

17440 STUDY OF THE CARBIDE PHASE IN TERNARY IRON-BORON-CARBON ALLOYS. Fomichev, O. I.; Katkov, V. F.; Kushmareva, A. K. Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 3, 119-121(1974). (In Russian).

The nature of the carbide phase over a wide range of B (0.25 to 4.0%) and C (3 to 5%) contents was studied. Metallographic data show that the primary carbide morphology varies with the B content. As the B content increases, the morphology changes from plates to three-dimensional branched primary carbide precipitates. Also, the study showed that a cementite-type rhombic carbide of non-stoichiometric composition is formed during crystallization. (Metals Abstr.)

17441 ALLOYING OF YuNDK24 [IRON-COBALT-NICKEL-ALUMINUM] WITH EUROPIUM. Effect on Structure and Magnetic and Mechanical Properties. Chernov, V. M. Liteinoe Proizvod.; No. 2, 30-31(Feb 1974). (In Russian).

The effect of alloying with Eu on the structure and mechanical and magnetic properties of the alloy YuNDK24 (Co 23, Ni 13.5, Al 8.5, Cu 3%, balance Fe) was studied. The addition of only 0.005% Eu sharply increased the magnetic energy; in addition to the excellent magnetic properties of the Eu-containing material the grinding and polishing capacity was high, in contrast to the untreated metal. In the presence of 0.5% Eu a δ-phase was precipitated; it lay between the precipitates of the α′ phase and like the latter exhibited a very anisotropic form. (Metals Abstr.)

17442 PROCHNOST' SPLAVOV TSIRKONIYA. (Stability of Zirconium Alloys). Rivkin, E. Yu.; Rodchenkov, B. S.; Filatov, V. M. Moscow; Atomizdat (1974). 168p.

Questions on the stability and strength of zirconium alloys are generalized and analyzed. The areas of usefulness of Zr alloys, their strength characteristics, and methods for the determination and evaluation of the strength are examined. Data are presented on the mechanical properties and the effects of different factors such as cold working, thermal processing, hydration, and irradiation on the mechanical properties are examined. Methods are given for the evaluation of the breaking strength of Zr alloys during static, prolonged static, and cyclic stress. The effects of exploitation conditions including irradiation are considered. Data are generalized on the characteristics of the cyclic and extended strength, creep, and stability. Recommendations are made on the principles of the calculation of the strength of articles made from Zr alloys. (tr-auth)

17443 ATOMIC-ABSORPTION SPECTROSCOPY STUDY OF Al-C REACTION AND OF HIGH-TEMPERATURE Al VAPORIZATION AND DIFFUSION IN REFRACTORY METALS. Bodrov, N. V.; Nikolaev, G. I. Zh. Prikl. Spektrosk.; 21: No. 3, 400-404 (Sep 1974). (In Russian).

Atomic-absorption spectroscopy in an open absorption cell was used to study the physico-chemical properties of Al and its compounds. The saturated vapor pressure of Al (10^{-3} to 10^{-1} mm Hg) was measured at 1300 to 1550°K. Voigt parameters were determined for the 308.2-, 309.3-, and 394.4-nm lines under the experimental conditions (3 atm Ar, 1300 to 1750°K). The temperature dependence of the activity coefficients of Al (impurity) in Nb and Ta were determined at 1650 to 2000°K, and equations were derived for expressing Al diffusion coefficients in Nb and Ta at 1750 to 2050°K. The kinetics of the Al_2O_3-C reaction at 1600 to 1800°K were studied. (tr-auth)

17444 IRRADIATION SWELLING RESISTANT ALLOY FOR USE IN FAST NEUTRON REACTORS. Bates, J. F.; Holmes, J. J.; Paxton, M. M.; Straalsund, J. L. (to United States Atomic Energy Commission). US Patent 3,856,517. 24 Dec 1974. Filed Date 26 Nov 1973. 6p.

Specifications are given for a stainless steel alloy particularly suited for use in fast neutron reactors. It has high resistance to void formation on irradiation by fast neutrons and excellent mechanical properties and is weldable. The basic composition in weight percent is, in addition to iron, chromium, 16.0 to 18.0; nickel, 11.0 to 14.0; molybdenum, 2.0 to 4.0; silicon, 1.1 to 2.0; manganese, 1.00 to 2.00; nitrogen, 0.04 to 0.06; carbon, 0.04 to 0.08; with certain limitation on other minor constituents. (Official Gazette)

17445 NICKEL-BASE ALLOY WITH UNUSUAL CREEP BEHAVIOR. Strobel, G. R. (International Nickel Co., Inc., Huntington, WV). Metals Eng. Quart.; 14: 12-16(May 1974).

Inconel alloy MA 753 is a nickel-base alloy containing 20 Cr, 2.5 Ti, 1.5 Al, and 1.3 Y_2O_3. It is mechanically alloyed, which permits gamma prime precipitation hardening to be combined with oxide dispersion strengthening for high creep strength over a wide temperature range. Creep properties were studied at 2100 and 1900°F. At 2100°F, the alloy exhibited either negative or positive creep, depending on its annealing treatment. At 1900°F, the alloy showed only positive creep. Creep behavior was investigated by metallographic examination of creep-test specimens. The two modes of creep (positive and negative) resulted from cavity suppression or formation. The Hull-Rimmer theory of cavity growth by vacancy condensation explained positive creep, while negative creep in specimens with cavity suppression was explained by vacancy migration. (IAA)

17446 MOESSBAUER AND X-RAY MEASUREMENTS ON SINGLE CRYSTALS OF Fe-Mo ALLOYS: A STUDY OF THE HYPERFINE FIELDS AND THE LOCAL ATOMIC ORDER. Asano, A. (Evanston, IL; Northwestern Univ.). 1974. 212p. University Microfilms Order No. 74-28,578.

Thesis (Ph. D.).

A Moessbauer effect study was performed on single crystals of Fe-3.8 at. % Mo, 3.2 at. % Mo and 1.7 at. % Mo specimens. All specimens were solution treated at 1050°C for an hour and annealed at 540°C for 2½ hours. A field of ~2.7 kOe was applied normal to the γ-ray propagation direction, and several spectra were taken with the sample saturated in directions in the $(0\bar{1}1)$ plane varying from [100] to [111]. The "thickness distortion" due to finite sample thickness was eliminated by an analytical method developed in the present research. In this method the true absorption cross-section is obtained by a procedure involving deconvolution from the measured spectrum. From the magnetization axis dependence of the Moessbauer spectra, it was found that: (1) an anisotropic interaction of magnetic dipolar type exists and (2) the magnitude of the interaction is of the same order as that of the isotropic perturbations of the satellite peaks. Due to this strong anisotropic interaction, previous interpretations of the Moessbauer spectrum of Fe-Mo alloys were found to have erroneously located the satellite peak of iron atoms with one solute next near neighbor. The absorption intensities of the satellite peaks in the Moessbauer spectrum were also measured to determine the extent of local atomic order. These results were compared with the same quantities obtained by x-ray diffuse scattering measurements made on Fe-3.2 at. % Mo. While the x-ray results indicate a weak clustering tendency, the Moessbauer data suggest a weak tendency for short-range order; however within the experimental errors, both techniques are consistent with a random solute distribution. (Diss. Abstr. Int., B)

17447 CURRENT OSCILLATIONS IN Nb_3Sn TUNNEL JUNCTIONS AT VOLTAGES ABOVE THE SUPERCONDUCTING GAP. Vedeneev, S. I.; Golovashkin, A. I.; Motulevich, G. P. (Lebedev Inst. of Physics, Moscow). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 3, 439-441(Sep 1974).

Translated from Fiz. Tverd. Tela; 16: No. 3, 668-671(Mar 1974).

Oscillations of the tunneling conductivity as a function of voltage have been observed in tunnel junctions with microbridges, for voltages above the superconducting gap. The periods of the oscillations agree with the energy gaps for the superconductors forming the tunnel junctions. Tunnel junctions formed by Nb_3Sn-Sn, Nb_3Sn-Pb, and Nb_3Sn-Nb_3Sn have been studied. A model is presented to account for the results obtained. (auth)

17448 CRITERION FOR THE APPEARANCE OF MULTIBAND SUPERCONDUCTIVITY IN ELEMENTS HAVING A COMPLEX FERMI SURFACE. Shchetkin, I. S. (Physical-Technical Inst. of Low Temperatures, Kharkov). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 3, 580(Sep 1974).

Translated from Fiz. Tverd. Tela; 16: No. 3, 906-907(Mar 1974).

The condition for the appearance of interband superconductivity is $\iota_{12(21)} \gtrsim \xi_0$ where ξ is the coherence length. It is noted that this condition takes fuller account of the features of electron energy spectrum of a superconductor having a complex Fermi surface and can be used as a criterion for the appearance of multiband superconductivity in such samples. (JRD)

17449 EFFECT OF PRESSURE ON THE SPIN-LATTICE RELAXATION IN A SUPERCONDUCTOR IN THE PRESENCE OF AN ELECTRONIC TRANSITION. Serdyuk, A. D.; Nguyen Van T'en; Fal'ko, I. I. (Kharkov State Univ.). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 3, 568-569(Sep 1974).

Translated from Fiz. Tverd. Tela; 16: No. 3, 886-889(Mar 1974).

The effect of pressure and the combined effects of pressure and nonmagnetic impurities on the rate of spin-lattice relaxation are analyzed for a superconductor with an electronic transition. The Green's-function technique is used to derive equations for the increment to T_1^{-1} of a superconducting metal due to the change in the topology of the Fermi surface caused by the pressure in a pure semiconductor and in one containing nonmagnetic impurities. In the case in which there is an electronic transition, the rate of the spin-lattice relaxation is a nonlinear function of the pressure and of the concentration of nonmagnetic impurities. The relative magnitude of the increment of T_1^{-1} depends on the effective masses. (auth)

17450 NEW GOLD RESISTANCE ALLOY: A STUDY OF THE GOLD–PALLADIUM–VANADIUM SYSTEM. Sperner, F. Gold Bull.; 6: No. 3, 72-76(Jul 1973).

The electrical resistivity, its temperature coefficient., and the thermal emf against Cu of alloys in the binary Au–V and Pd–V systems containing V $\ngtr$18 and 14 wt.-%, respectively and of ternary alloys in the Au–Pd–V system containing V 5 and 10% were measured. The results are shown graphically. In these systems, workable noble-metal alloys were found having values of resistivity of >200 microhm/cm. The preferred alloy contains Au with V 10 and Pd 20%, has a slightly negative temperature coefficient of resistance, and a negligible emf against Cu. (Metals Abstr.)

17451 APPEARANCE OF DISLOCATIONS IN FORMATION AND HEALING OF MICROCRACKS IN TUNGSTEN AND MOLYBDENUM SINGLE CRYSTALS. Larikov, L. N.; Maksimenko, E. O. (Inst. of Metal Physics, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 11, 1043-1045(Nov 1974). (In Ukrainian).

The paper deals with the appearance of dislocations in formation of microcracks and their healing in tungsten and molybdenum single crystals oriented in the plane $\{100\}$. The microcracks appeared in the surface layers of the single crystals under the effect of electrospark discharge. Healing of the microcracks occurs in the process of high-temperature annealings. Under these conditions the process of healing proceeds differently in the volume of the crystal and on its surface. The healing to microcracks in the crystal depth is due to their decomposition onto dislocation walls according to the mechanism theoretically described in literature. Experimental data and theoretical calculation are in satisfactory agreement. (auth)

17452 COMPARATIVE CHARACTERISTICS OF NIOBIUM ALLOYS PRECIPITATION STRENGTHENING BY CABIDES AND NITRIDES. Malashenko, I. S.; Moiseev, V. F.; Trefilov, V. I. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 11, 84-97(Nov 1974). (In Russian).

The possibilities of precipitation strengthening niobium alloys by introducing carbon and nitrogen are analyzed. Peculiarities of carbide and nitride strengthenings in binary and ternary alloys are considered as influencing the choice of composition, production and processing technique as well as the possibility of using these alloys within the definite range of temperatures and loadings. (14 fig, 4 references) (auth)

17453 THERMAL PROPERTIES OF POROUS TUNGSTEN AT TEMPERATURES 1200 TO 3200°K. Pustogarov, A. V.; Mel'nikov, G. N.; Kolesnichenko, A. N.; Daragan, V. D.; Chepiga, D. D. Porosh. Met., Akad. Nauk Ukr. SSR; No. 11, 52-57(Nov 1974). (In Russian).

Results are presented of a study of the electric resistance, heat capacity, monochromatic and integral emissivities of porous tungsten (porosity = 20 to 35%) at 1200 to 3200°K. (6 fig) (auth)

17454 MECHANISM OF THE FORMATION OF ZIRCONIUM CARBIDE ON GRAPHITE FROM A METALLIC MELT. Asaturov, S. A.; Gorbunov, N. S. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 94-97(1973).

The interaction of graphite with molten metals is of particular interest in high-temperature technology. The formation of a carbide layer on the graphite can take place in two stages: In the first stage the C is dissolved in liquid Zr, and then after the C concentration in the liquid metal reaches a certain value, a carbide film begins to form. The two processes can also occur simultaneously. Diffusion equations are developed, and variations in microhardness of the ZrC layer under different conditions, as well as changes in lattice constants, are shown. (Metals Abstr.)

17455 EFFECT OF BORON–COPPER PLATING ON THE STRENGTH AND WEAR RESISTANCE OF MEDIUM CARBON STEEL. Pokhmurskii, V. I.; Vagula, R. G.; Gribovskii, Ya. S.; Zamikhovskii, V. Z. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 236-239(1973).

A principal deterrent to the use of boriding of machine parts for wear resistance is brittleness of the coating. Addition of 2 to 8% Cu powder to the B_4C and borax powder mixture was investigated. The addition of Cu reduced the boride case depth and the depth of the transition zone by a factor of 1.5-2. Mechanical test results showed that additions of 2 to 4% Cu substantially increased the ductility of the diffusion layer and did not materially reduce the surface hardness, friction properties, or fatigue strength. (Metals Abstr.)

17456 MOBILITY OF ATOMS OF ^{26}Al IN INTERMETALLIC PHASES OCCURRING DURING ALUMINIZING OF STEEL. Larikov, L. N.; Fal'chenko, V. M.; Polishchuk, D. F.; Ryabov, V. R.; Lozovskaya, A. V. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 116-117(1973).

The diffusion mobility of Al was investigated using radioactive indicators at 520 to 650°C. Values of the diffusion coefficients are tabulated for 520, 580, and 600°C, and indicate that the diffusion of ^{26}Al in intermetallic phases occurs more rapidly than the diffusion of ^{59}Fe (two or three times faster in $FeAl_3$). (Metals Abstr.)

17457 MAGNETIC PROPERTIES OF $NdAl_2$. Bak, P. (Danish Atomic Energy Commission, Risoe). J. Phys., C (London); 7: No. 22, 4097-4103(21 Nov 1974).

The magnetic properties of $NdAl_2$ are calculated using a Hamiltonian including crystal-field and isotropic exchange interaction terms. A two-dimensional mean-field theory is evaluated to calculate single-crystal magnetization curves. It is shown that the magnetic properties can be understood using the crystal-field parameters derived from the magnetic exciton spectrum measured by Houmann et al., (J. Phys. C: Solid State Phys.; 7 : 2691 (1974)) by means of inelastic neutron scattering. The combined λ-Schottky anomaly in the heat capacity is explained. No additional parameters are introduced. (auth)

17458 DIFFUSION GROWTH OF PHASES IN THREE-COMPONENT SYSTEMS WITH INTERACTION OF ELEMENTS. Shcherbedinskii, G. V.; Kondrachenko, L. A. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 25-32(1973).

A mathematical analysis is given for the growth of phases in a three-component alloy, based on the main elements of the thermodynamic theory of multicomponent diffusion that was recently developed to describe diffusion in solid solutions. As the result of saturation with one of the elements, a layer of a new phase is formed on the surface that increases in thickness by means of diffusion. The analysis is illustrated for the system Fe–Me–C (Me being any metallic alloying element). (Metals Abstr.)

17459 DIFFUSION OF COMPONENTS OF NIOBIUM AND NICKEL ALLOYS IN CONTACT. Vasil'eva, E. V.; Prokoshkin, D. A.; Vasil'eva, A. I.; Kapralov, V. P.; Sigachev, A. P. Prot. Coatings Metals (USSR) (Engl. Transl.); 5: 53-56(1973).

The two alloys studied were a Nb alloy containing 25% Ti and 8% Al, and a Ni alloy containing 27% Cr, 2.5% Al, 0.8% Si, 0.2% Mn, 0.5% Fe, 0.08% C, 0.02% S and 0.02% P. Sleeves were machined from the alloys and the connecting flanges were polished and heated in vacuum to 1050°C. The diffusion zone was subjected to metallographic analysis, microhardness was measured in the base metals and the contact zone, and a limited-area x-ray spectral analysis was made. Diffusion of the various elements at the contact zone is discussed in relation to factors such as diffusion mobility at the experimental temperature and the activity of the chemical reaction with such elements as C. (Metals Abstr.)

17460 STACKING FAULT PROBABILITIES IN BCC Zr–Mo ALLOYS. Sastry, D. H.; Luton, M. J.; Jonas, J. J. (McGill Univ., Montreal). Phil. Mag.; 30: No. 5, 1187-1190(Nov 1974).

Beta Zr–Mo alloys containing 2, 4, and 6% Mo were quenched from 950°C and deformed by filing. X-ray line-breadth analysis revealed that the presence of stacking faults is a factor contributing to particle-size broadening. The compound fault probability $(1.5\,\alpha + \beta)/1.5$ increased with Mo content, indicating a probable decrease in the stacking fault energy of bcc zirconium alloys with increase in Mo content. (auth)

17461 CONTRIBUTION OF DISSOLVED OR PRECIPITATED OXYGEN TO THE ELECTRICAL RESISTIVITY OF VANADIUM. Eto, M.; Narutani, T. (Japan Atomic Energy Research Inst., Ibaraki). J. Mater. Sci.; 9: No. 11, 1902-1904(Nov 1974).

It is widely said that the so-called stage III "recovery" of bcc metals originates in the existence of impurity interstitials, although some investigators have pointed out the importance of the role of intrinsic defects produced by irradiation or cold-work. Recently, for neutron-irradiated vanadium, Stanley et al. (Act. Met.; 20 : 191 (1972)) have concluded that the decrease in resistivity of 3.2 $\mu\Omega$-cm $(\text{at.\%})^{-1}$ after annealing results from the precipitation of impurity interstitials at the radiation-produced defects. In their experiments, this value was about 36% of the resistivity increase caused by the dissolution of 1 at.% of impurity interstitials. From this fact, it is expected that in the case of cold-worked specimen, the decrease in resistivity due to ageing or annealing treatments must also considerably differ in amount from the increase due to dissolution of the oxygen atom. The purpose of this paper is to investigate the difference in the resistivity changes caused by dissolved and strain-aged oxygen in vanadium. (auth)

17462 BORON/ALUMINUM–GRAPHITE/RESIN ADVANCED FIBER COMPOSITE HYBRIDS. Chamis, C. C.; Lark, R. F.; Sullivan, T. L. (Lewis Research Center, Cleveland). pp 369-385 of Sixth National SAMPE Technical Conference. Vol. 6. Azusa, CA; Society for Advancement of Material and Process Engineering (1974).

From sixth national SAMPE technical conference on materials on the move; Dayton, Ohio, USA (8 Oct 1974). See CONF-741058-.

An investigation was conducted to determine the fabrication feasibility and to assess the potential of adhesively bonded metal and resin matrix fiber composite hybrids as an advanced material, for aerospace and other structural applications. Results of fabrication studies and of evaluation of physical and mechanical properties show that using this hybrid concept, it is possible to design a composite which, when compared to nonhybrid composites, has improved transverse strength, transverse stiffness, and impact resistance with only a small penalty on density and longitudinal properties. Results also show that laminate theory is suitable for predicting the structural response of such hybrids. The sequence of fracture modes indicates that these types of hybrids can be readily designed to meet fail-safe requirements. (auth)

17463 INVESTIGATION OF THE LOW-TEMPERATURE THERMOELECTRIC PROPERTIES OF TUNGSTEN BY A FIELD-NULLING TECHNIQUE. Garland, J. C.; VanHarlingen, D. J. (Ohio State Univ., Columbus). Phys. Rev., B; 10: No. 12, 4825-4841(15 Dec 1974).

The thermoelectric dc transport properties of five single-crystal tungsten samples have been measured over the temperature range 1.2 to 7°K. In addition to the electrical resistivity, thermal resistivity, and thermoelectric power, a new thermoelectric function G(T) was determined; the properties of this function and the method for measuring it are analyzed. Evidence for electron-phonon scattering was observed for both the electrical and thermal resistivity, appearing as a deviation from a quadratic temperature dependence usually associated with the electron-electron interaction. The thermoelectric coefficients S(T) and G(T) were positive below about 5°K for all samples with a sign reversal occurring at higher temperatures. Below 3°K, a marked impurity dependence in the thermoelectric properties was observed. No sample exhibited the characteristic temperature dependence of electron-electron scattering. The sign reversal at higher temperatures is attributed to the onset of a phonon-drag mechanism. (auth)

17464 DOPPLER-SHIFTED ACOUSTIC CYCLOTRON RESONANCE IN INDIUM. Hayden, S. C.; Reed, R. W.; Brickwedde, F. G. (Pennsylvania State Univ., University Park). Phys. Rev., B; 10: No. 12, 4842-4848(15 Dec 1974).

The Fermi surface (FS) in In was investigated by the method of the Doppler-shifted cyclotron-resonance absorption of longitudinal sound (100 to 300 MHz) in magnetic fields from 0.5 to 50 kG. Extremal values of $|\delta A_{\perp}(k_B)/\delta k_B|$ were determined: $A_{\perp}(k_B)$ is the area of cross section of the FS perpendicular to $\vec{B}$ through the end of the vector $k_B \hat{B}$. The sonic absorption was measured by the pulse-echo method. In has a fct structure. $\vec{q}$ was parallel to [001], [100], and [110] directions. $\vec{B}$ was varied in the (010), (001), and (110) planes. None of the observed absorption resonances appears to originate on the second-zone Fermi-hole surface. The most consistent interpretation of the Doppler-shifted acoustic cyclotron resonances (DSACR) is that they arise from the third-zone electron FS, including both the α and β arms. In most, but not all, of the investigations of the FS in In by other methods, the α arms have not appeared. Local pseudopotential models for In have been based on the assumption that the α arms do not exist or are very small. While the existence of the α arms is not proven their existence is supported by this investigation. The amplitude of one series of DSACR oscillations was observed to decrease linearly with T. (auth)

17465 SUPERCONDUCTING GERMANIUM TELLURIDE IN THE TELLURIUM–GERMANIUM–ARSENIC SYSTEM. Gerber, J. A. Medford, MA; Tufts Univ. (1974). 232p. University Microfilms Order No. 74-28,563.

Thesis (Ph. D.).

Studies of alloys in the Te–Ge–As system have shown that superconductivity in this system is due to the presence of the superconducting semiconductor GeTe. Scanning electron micrographs show that the polycrystalline alloy $Te_{0.81}Ge_{0.15}As_{0.04}$ (composition in at. %), and other similar alloys, solidify in a lamellar structure of alternating GeTe and Te lamellae. Given the proper heat treatment the alloy $Te_{0.81}Ge_{0.15}As_{0.04}$ has a transition temperature (0.8K to 0.9K) over twice as high as pure GeTe. Heat capacity measurements show this to be a bulk transition of the entire GeTe-phase found in this alloy and that for this GeTe-phase the thermodynamic critical field has the value $H_c(0) = 50G$. The normal state electronic specific heat of the GeTe-phase (138T erg/g-K^2) is found to be over twice as large as for pure GeTe. For the highest transition temperatures x-ray diffraction experiments show that the GeTe lattice is rhombohedrally distorted with respect to pure bulk GeTe and that the rhombohedral angle is 86.5 ± 0.5°. Magnetic and resistive measurements show that $Te_{0.81}Ge_{0.15}As_{0.04}$ is an irreversible dirty Type II superconductor with $H_{c_2}(0) = 3.2kG$ and $\kappa = 40$. Evidence is also found for the existence of surface superconductivity at the GeTe-Te interface. Other crystalline Te–Ge–As alloys are also discussed. The heat capacity of amorphous $Te_{0.81}Ge_{0.15}As_{0.04}$ has been measured for $0.25K < T < 4°K$. This alloy is found to have a contribution to the specific heat which depends linearly on temperature (2.3T erg/g-K^2) and is three times smaller in magnitude than any such linear contribution measured to date. (Diss. Abstr. Int., B)

17466 TITANIUM–BERYLLIUM REINFORCED MATRICES. Trabocco, R. E.; DeLuccia, J. J. (to Secretary of the Navy). US Patent 3,847,558. 12 Nov 1974. Filed Date 24 Aug 1972. 4p.

A composite material having greater strength to density and modulus to density ratios than existing monolithic materials comprises a titanium alloy having either beryllium wires or beryllium wires having a titanium cladding or wrapping for reinforcement. In forming the composite, laminates of titanium alloy sheets are explosively welded to beryllium wire reinforcement or titanium clad or wrapped beryllium wire reinforcement by stacking the laminates in layers with the wires placed between layers and explosively welding the layers and wires together. (Official Gazette)

17467 p–T PHASE DIAGRAM FOR THE ZIRCONIUM–NITROGEN SYSTEM. Levinskii, Yu. V. (Moscow Inst. of Steel and Alloys). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 4, 486-488(Apr 1974).

Translated from Zh. Fiz. Khim.; 48: No. 4, 845-847(Apr 1974).

A schematic p–T phase diagram for the zirconium–nitrogen system was proposed on the basis of an analysis of experimental data. Various isobaric and isothermal sections through the three-dimensional diagram are presented and discussed. It is shown how temperature and pressure influence the phase equilibria in this system. (auth)

17468 STRUCTURE AND CHARACTERISTICS OF UNIDIRECTIONALLY SOLIDIFIED EUTECTIC Ni–Ni_3Ta. Bassi, A. (Centro Informazioni Studi ed Esperienze, Milan); Wenger, D.; Dejace, J.; Matera, R. Kovove Mater.; 12: No. 2, 165-175(1974).

17469 SMALL IMPULSE AND VELOCITY OF DENSE, POROUS, AND POWDERED TANTALUM AND LEAD INDUCED BY A PULSED ELECTRON BEAM. White, P. H.; Gobbett, R. H. (United Kingdom Atomic Energy Authority, Aldermaston, Eng.). J. Phys., D (London); 7: No. 17, 2342-2354(21 Nov 1974).

The impulse, surface velocity and mass of dense, porous or powdered tantalum or lead spalled by an electron beam were measured for energy fluxes in the range 10 to 500 J cm^{-2}. The highest energy flux gives an energy deposition sufficient to vaporize the tantalum and ~4 times the energy required to vaporize the lead surface. In dense tantalum and lead the measured impulse agreed to within ~10% with that calculated by a computer program using a single-phase equation of state. The impulses from porous lead and tantalum of ~0.92 solid density were measured to be within 10% of the impulse from dense material and are predicted reasonably well by a $(pa\tau)$ equation of state if relaxation times greater than 50 to 100 ns are assumed. Impulses from powdered lead or tantalum of ~0.5 the full density are ~0.6 the fully dense impulse and are also compared with a $(pa\tau)$ equation of state. (auth)

17470 MAGNETIC PROPERTIES OF CsCl-TYPE RARE-EARTH CADMIUM COMPOUNDS. Buschow, K. H. J. (Philips Research Labs., Eindhoven, Netherlands). J. Chem. Phys.; 61: No. 11, 4666-4670(1 Dec 1974).

The magnetic and crystallographic properties of rare-earth cadmium compounds of equiatomic composition were studied. All compounds were found to be ferromagnetic. Indications were obtained that the CsCl structure type is not stable at all temperatures. The magnetic properties of the rare-earth cadmium compounds are compared with the isostructural zinc and magnesium compounds. It is suggested that, apart from the RKKY interaction involving s-conduction electrons, there exists a second coupling mechanism which in some cases even predominates. (auth)

17471 ANALYSIS OF LIQUID METAL EMBRITTLEMENT FROM A BOND ENERGY VIEWPOINT. Kelley, M. J. (Du Pont de Nemours Co. Inc., Wilmington, DE); Stoloff, N. S. Met. Trans.; 6: No. 1, 159-166(Jan 1975).

Absorption induced embrittlement of solid metals by certain liquid metals is analyzed through an Engel-Brewer calculation of the solid-liquid interaction energy, and the effect of the latter in reducing fracture surface energy. The reduction in fracture surface energy is estimated by comparison of the electronic contribution to the solid-liquid interaction energy with solid-solid bond energy for some 40 liquid-solid couples. Regular solution theory is used to estimate mutual solubility as the relative difference in parameter values. Embrittlement can be predicted by using reduction in fracture surface energy and solubility parameter difference as critical variables. The effect of solute additions to the liquid on the degree of embrittlement is interpreted via the same two variables; the principal effect of solutes is to modify solubility relationships at the solid-liquid interface. Finally, since solute additions to the solid may affect the yield stress, Petch slope and fracture surface energy in air, the Cottrell-Petch fracture relation is shown to be a necessary framework for interpreting the effects of such additions on embrittlement phenomena. (auth)

17472 GRAIN GROWTH IN DISPERSION STRENGTHENED SUPERALLOYS BY MOVING ZONE HEAT TREATMENTS. Cairns, R. L.; Curwick, L. R.; Benjamin, J. S. (International Nickel Co. Inc., Suffern, NY). Met. Trans.; 6: No. 1, 179-188(Jan 1975).

The high temperature strength of dispersion strengthened materials is limited by grain boundary sliding and transverse boundary rupture. These effects are minimized through development of materials with elongated or fibrous grain structures. Thermomechanical processing and grain growth heat treatments are used to develop coarse elongated grain structures in dispersion strengthened nickel-base superalloys made from mechanically alloyed powder. Grain size and aspect ratio are increased by using a moving hot zone to accomplish grain growth. The application of this technique to extruded bar of two nickel-base superalloys, IN-853 (Alloy A) and a developmental alloy (Alloy B) with composition: 15Cr, 4.5Al, 2.5Ti, 2Ta, 3.5Mo, 4W, 0.15Zr, 0.01B, 1.1Y_2O_3 is discussed, and the relation between grain aspect ratio and mechanical properties in these materials is presented. (auth)

17473 THERMALLY ACTIVATED DISLOCATION MOTION IN NEUTRON IRRADIATED IRON–NICKEL ALLOYS. Kuo, C. T. K.; Arsenault, R. J. (Univ. of Maryland, College Park). Contract AT(40-1)-3612. Met. Trans.; 6: No. 1, 207-212(Jan 1975).

Polycrystalline samples of iron–nickel alloys with various interstitial impurity levels were irradiated to a fluence of 1.6×10^{19} n/cm^2 ($E > 1$ MeV). The temperature and strain rate dependence of the yield stress of the alloys have been investigated in the temperature range of 77 to 580°K. The activation parameters have also been evaluated and used to identify the rate controlling mechanisms of the dislocation motion. It was observed that above 300°K the thermally activated dislocation motion over the neutron-produced obstacles is the rate controlling mechanism for the irradiated samples. This observation is in agreement with a prediction made by Arsenault. The effect of post-irradiation annealing on the temperature dependence of the yield stress becomes significant above 400°K; therefore, by the single strain rate change tests there is no way to determine the athermal stress for the irradiated samples. The motion of double kinks in dislocations over the Peierls' stress hill is the lower temperature rate controlling mechanism before and after neutron irradiation. (auth)

17474 EFFECT OF ALUMINUM ADDITION ON THE PRECIPITATION BEHAVIOR OF A Co–Ni–Cr BASE SUPERALLOY CONTAINING Nb. Ravindran, C.; Chaturvedi, M. C. (Univ. of Manitoba, Winnipeg). Met. Trans.; 6: No. 1, 213-217(Jan 1975).

The effect of Al addition of a new Co–Ni–Cr base superalloy containing Nb is discussed. The main strengthening phase was found to be γ' which grows by Lifshitz–Wagner theory of diffusion controlled growth. On prolonged aging, γ' loses its coherency with the matrix but maintains its ordered fcc structure. Carbon, present as an impurity element, gave rise to NbC phase which precipitates at the grain boundary as well as within the grains. Occasionally sigma phase was also observed in the overaged specimens. An attempt has also been made to analyze the structure of the precipitates on the electronic consideration of Engel–Brewer theory. (auth)

17475 SOME ASPECTS OF PRECIPITATION OF COPPER AND COLUMBIUM (Nb) CARBIDE IN AN EXPERIMENTAL HIGH STRENGTH STEEL. Krishnadev, M. R.; Galibois, A. (Univ. Laval, Quebec). Met. Trans.; 6: No. 1, 222-224(Jan 1975).

Results of the studies indicate that 1) age hardening of rapidly cooled copper–niobium steels is due, in addition to the formation of copper-rich clusters, to the formation of metastable zones or clusters of niobium carbide whose nature and composition is yet to be determined, and 2) higher strength values coupled with reasonable ductility and toughness may be obtained in Cu–Nb steels by employing higher copper and niobium contents than is the normal practice. (auth)

17476 MICROSTRUCTURE OF EXTRUDED RODS AND DRAWN WIRES OF BERYLLIUM. Chin, G. Y. (Bell Labs. Murray Hill, NJ). Met. Trans.; 6: No. 1, 238-240(Jan 1975).

A basic explanation of the curled grain structure in extruded Be is given, using an analysis pertinent to the deformation modes of Be. Electron microscopic analyses are used to support the proposed structure. (JRD)

17477 CsCl-TYPE ORDER–DISORDER TRANSITION TEMPERATURE IN VMn ALLOYS. Suzuki, T.; Hagiwara, M. (Tokyo Inst. of Tech.). Met. Trans.; 6: No. 1, 241-242(Jan 1975).

The CsCl-type order–disorder transition temperature in VMn alloys was investigated by differential thermal analysis and specific heat measurements. Results are presented graphically and analyzed. (JRD)

17478 MECHANISM OF UAl_3 TO UAl_4 TRANSFORMATION. Lee, L. P.; Leighly, H. P. Jr. (Univ. of Missouri, Rolla). Met. Trans.; 6: No. 1, 135-139(Jan 1975).

The compound, UAl_4, which forms during the peritectic reaction (Liquid + $UAl_3 \rightarrow UAl_4$), has a long needlelike shape and reveals the characteristic morphology of a fishtail when cut along the long axis. When cut perpendicular to the long axis, it shows an internal core of another phase, which has been identified as a primary aluminum solid solution. Because of the interesting relationship between the crystallographic structures of UAl_3 and UAl_4, the peculiar UAl_4 morphology can be explained on the basis of a proposed mechanism. The mechanism of UAl_3 to UAl_4 transformation has been identified as shear and diffusion controlled transformation. (auth)

17479 EFFECT OF THERMAL CYCLING ON THE MECHANICAL PROPERTIES OF VARIOUS ALUMINUM ALLOYS REINFORCED WITH UNIDIRECTIONAL BORON FIBERS. Wright, M. A. (Univ. of Tennessee Space Inst., Tullahoma). Met. Trans.; 6: No. 1, 129-134(Jan 1975).

The mechanical properties of boron reinforced 6061, 1100, or 2024 aluminium alloys were measured at room temperature in the as-received condition and after thermal cycling. It was observed that cycling these materials through temperatures that varied between room temperature and either 588, 638, or 698°K could seriously degrade the properties. Observations of the surfaces of some specimens indicated that small perturbations appeared after very few cycles. These widened and deepened as the test proceeded until they developed into macroscopically visible surface cracks. The appearance of these cracks coincided with the maximum degradation of the mechanical properties. The extent of the observed effects depended on alloy type and the maximum cyclic temperature used. Increasing the maximum temperature produced an increase in the damage. The properties of the reinforced 2024 material were the most affected. A smaller degradation was produced in the properties of the 6061 material; however, some of the properties of the reinforced 1100 material were improved slightly. (auth)

17480 DEFORMATION KINETICS OF THE Ti–6Al–4V ALLOY AT LOW TEMPERATURES. de Meester, B.; Doener, M.; Conrad, H. (Univ. of Kentucky, Lexington). Met. Trans.; 6: No. 1, 65-75(Jan 1975).

The deformation kinetics of the $\alpha + \beta$ titanium alloy Ti–6 Al–4V were investigated over the temperature range of 4.2 to 760°K. It was found that the Gibbs free energy of activation ΔG at 0°K and zero effective stress is ~1.3 eV (~ 1.25×10^5 J/mole) (~0.17 $\mu_0 b^3$), the maximum force for the dislocation-obstacle interaction is ~80×10^{-6} dyne (~80×10^{-11} N) (~0.19 $\mu_0 b^2$) and the activation distance x_0^* at which the force first rises rapidly ~1.5 b. These quantities, and others, are the same as those for unalloyed titanium, where it was established that interstitial solutes are the obstacles controlling the dislocation motion. The results for the Ti–6 Al–4V alloy are in slightly better accord with ΔG being independent of temperature than proportional to the shear modulus, but the evidence is not conclusive. (auth)

17481 EFFECT OF Al, Ti, AND Zr ON Ni_3Fe SUPERSTRUCTURE. Goman'kov, V. I.; Puzei, I. M.; Kozis, E. V.; Mal'tsev, E. I.; Mokhov, B. N. (Central Scientific-Research Inst. of Ferrous Metallurgy, Moscow). Fiz. Metal. Metalloved.; 38: No. 3, 647-649(Sep 1974). (In Russian).

Studies on cylindrical polycrystalline samples of Ni_3Fe containing up to 5% Al, Ti, or Zr showed that, in the presence of these alloying elements, new phases may form made up chiefly of one of the elements of the matrix. Thus the composition differs from stoichiometric Ni_3Fe and concentration disorders result. (SJR)

17482 TIME DEPENDENCE OF DISCONTINUITIES IN CREEP DEFORMATION IN SUPERCONDUCTING TRANSITIONS. Vainblat, T. I. (Physical-Technical Inst. of Low Temperatures, Kharkov). Fiz. Metal. Metalloved.; 38: No. 3, 638-640(Sep 1974). (In Russian).

Samples of 99.999% pure lead monocrystals were stress deformed in a creep regime at 4.2°K until the superconducting state was reached. The results are presented graphically and discussed relative to literature data in the same field. (SJR)

17483 BRITTLENESS AND HEAT RESISTANCE OF Mo ALLOY TsM-2A AFTER NITRIDING. Shashkov, D. P. (Moscow Automobile and Highway Inst.). Fiz. Metal. Metalloved.; 38: No. 3, 619-630(Sep 1974). (In Russian).

The effect of tempering from 2000°C, using a high vacuum, Ar, or a mixture of Ar and N_2 in the heating and holding, on the temperature threshold of brittleness of alloy TsM-2A before and after nitriding was studied. The temperature threshold was shown to be affected by the internal adsorption of nitrogen along the grain boundaries and by formation of Mo nitrides, especially at the grain boundaries. An effect of hot plastic deformation by pressing in the absence of recrystallization and hydroextrusion at the temperature threshold of brittleness of the nitrided alloy and a tendency to adsorb nitrogen on the grain boundaries were shown. Comparison of the resistance of alloy TsM-2A before and after nitriding showed the effect of the nitriding process carried out with tempering in Ar or a mixture of Ar and N_2 with subsequent plastic deformation. (tr-auth)

17484 PLASTIC DEFORMATION IN THE TEMPERATURE INTERVAL 4.2–300°K. Abraimov, V. V.; Efimov, Yu. V.; Kozlova, N. D.; Savitskii, E. M.; Startsev, V. I. (Physical-Technical Inst. of Low Temperatures, Kharkov). Fiz. Metal. Metalloved.; 38: No. 3, 612-618(Sep 1974). (In Russian).

The plastic behavior of 99.98% pure V monocrystals at temperatures from 4.2 to 300°K with deformation at a constant rate and the effect of superconducting transition at 4.2°K were studied. Hardening curves were obtained at 4.2 to 300°K. Data were obtained on flow limits at 293 and 77°C and on tension at the beginning of V twinning at 4.2°K in normal and superconducting states. The effect of superconducting transition in the twinning process at 4.2°C was studied. It was shown that discontinuities in the deformation curves obtained in the superconducting state have higher values than those for the normal state. Experimental data indicate that the transition to the superconducting state affects the rate of formation of concentrates of internal stress on the production of twinning dislocations. (tr-auth)

17485 COMPOSITION AND STRUCTURE OF CARBONITRIDE PHASES OF V AND Nb IN LOW-CARBON STEEL. Cheremnykh, V. G.; Shklyar, R. Sh.; Gol'dshtein, M. I.; Chirkova, S. N. (Ural Polytechnic Inst., Sverdlovsk, USSR). Fiz. Metal. Metalloved.; 38: No. 3, 541-547(Sep 1974). (In Russian).

X-ray studies were made on the effect of the composition of the steel and the standardization temperature on the composition of the electrolytically isolated carbonitride phases formed in low-carbon steels alloyed with V, Nb, or both. Lattice parameters and ratio of intensities of the interference lines $(111)_\alpha$ and $(200)_\beta$ gave preliminary values of the composition of the carbo-nitride phases. The composition and structure of these phases were shown to depend on the composition of the steel and the heat treatment it had undergone. (tr-auth)

17486 DISTRIBUTION OF N ATOMS IN Nb SOLID SOLUTIONS. Elyutin, V. P.; Mozzhukhin, E. I.; Maksimov, D. G. (Moscow Steel and Alloy Inst.). Fiz. Metal. Metalloved.; 38: No. 3, 564-570(Sep 1974). (In Russian).

An internal friction method was used to study solid solutions of Nb–Ti–N. The coefficients of N distribution between positions in which N atoms are surrounded by only Nb atoms and those in which some of the surrounding atoms are of the alloying element were determined. The enthalpy and entropy of transfer of N atoms from one position to the other were found from the temperature dependence of the N distribution coefficient in Nb–Ti–N alloys and in the Nb–Zr–N and Nb–Hf–N alloys studied earlier. (tr-auth)

Radiation Effects

Refer also to abstracts 17017 and 17605.

17487 (ANL-8125) FUEL-ASSEMBLY MATERIALS SIMULATION PROGRAM: STATUS REPORT. Roberts, J. T. A.; Weins, J. J.; Youngdahl, C. A.; Yaggee, F. L.; Maiya, P. S.; Spruiell, J. E. (Argonne National Lab., Ill. (USA)). Oct 1974. Contract W-31-109-eng-38. 30p. AT.

Results and preliminary recommendations from the first year of effort to simulate the effects of irradiation in fuel-assembly materials are given. The objective was to develop thermomechanical and thermochemical treatments of type 316 stainless steel that will reduce metal ductility to the $\lesssim 1\%$ strain level during heating ramps of ~6–111°C/s. A 50% cold-worked, or 50% cold-worked and aged, type 316 stainless steel cladding tube fails after <1% stable strain at 2100 to 2300°F, when subjected to a 200°F/s heating ramp, but undergoes some receovery at the lower heating rates. A uniformly nitrided cladding tube, on the other hand, maintains the <1% strain embrittlement level under 10°F/s heating. It is therefore concluded that either thermomechanical or thermochemical treatment of type 316 stainless steel can provide a basis for the simulation of cladding and duct materials, but the thermomechanical approach will be limited to either room-temperature tests or accident simulations involving rapid thermal transients. The study also included the effects of fission products and sodium on type 316 stainless steel and the effects of irradiation on the oxide fuel. The former could be simulated effectively by a simple reduction in cladding- or duct-wall thickness. Cracking and restructuring of the fuel could be achieved by a short preirradiation before the accident experiment, but fission-gas buildup could not be simulated. It was therefore recommended that irradiated fuel be used in the experiment in which these effects might be important. (auth)

17488 (BARC/BIB-19) BIBLIOGRAPHY ON ION IMPLANTATION IN SOLIDS (1969–1973). Nagarathna, R. A. (comp.). (Bhabha Atomic Research Centre, Bombay (India). Library and Technical Information Section). 1973. 101p. INIS.

A bibliography is presented on ion implantation in solids citing 351 references published during 1969 to 1973 under 6 sections: (i) general and review papers, (ii) applications to semiconductor devices, (iii) ion sources and allied industries, (iv) physical and chemical effects on crystals, (v) radiation damage, and (vi) range, energy and scattering measurements. References are arranged alphabetically by first author. Wherever possible, each reference is provided with an informative abstract. An author index is provided. (INIS)

17489 (COO-125-57) FINAL REPORT ON STUDIES OF THE EFFECTS OF RADIATIONS. MacKay, J. W. (Purdue Univ., Lafayette, Ind. (USA)). 14 Jun 1974. Contract AT(11-1)-125. 11p. Dep. NTIS $4.00.

Research results are reported on radiation effects on Ge, annealing of Ge, stored energy release in Ge, electric conductivity of Ge, Si lattice parameters, and radiation effects on Si. (JRD)

17490 (COO-2206-5) VOID NUCLEATION AND GROWTH IN HEAVY ION AND ELECTRON BOMBARDED PURE METALS. Progress Report, March 1–December 1, 1974. Kulcinski, G. L.; Dodd, R. A. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 1974. Contract AT(11-1)-2206. 75p. Dep. NTIS $6.75.

Irradiation of high-purity Al with 1.2 to 1.4-MeV Al ions 30 to 120°C revealed that He has very strong influence on void formation. No voids could be formed in Al without He even up to 2.7 dpa. Samples preinjected with 0.1, 1, and 10 appm He and then irradiated at 100 and 120°C produced voids at damage levels of ~0.5 dpa. Void size and density varied with temperature and the voids were determined to be ⟨111⟩ octahedra. A high-temperature (1100°C) and high-vacuum ($<10^{-6}$ torr) sample irradiation chamber was constructed and operated; a residual gas analyzer was used to determine the partial pressures of the gases in the chamber during high-temperature irradiation of V. Partial pressures of hydrocarbons and oxygen atoms were $<10^{-10}$ torr during the irradiation runs, reducing the impurity pickup and precipitation reactions in the high-purity V. Voids were produced in high-purity V during bombardment at 700°C with 14-MeV copper ions. The average void size is ~1000Å, larger than previous values. The EM-7 1 MeV TEM has been placed into full operation for irradiation studies. Well-annealed Al, without preinjected helium, has been irradiated in this microscope at 37 to 150°C to approximately 0.9 dpa. A highly developed loop structure was observed, but no voids ($>10^{11}$ cm^{-3}) were observed. The prismatic dislocation loops were 60% interstitial and 40% vacancy. (32 fig, 7 tables, 48 references) (auth)

17491 (HEDL-TME-74-51) IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. Semi-annual Progress Report, February–July 1974. Claudson, T. T. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-2170. vp. Dep. NTIS $7.60.

Results of research on radiation damage in reactor materials and on properties of reactor materials are presented. The research was conducted by Aerojet Nuclear Company, Atomics International, General Electric Company, Hanford Engineering

Development Laboratory, Naval Research Laboratory, Oak Ridge National Laboratory, Pacific Northwest Laboratory, and University of Cincinnati. (JRD)

17492 (IPP-9/17) FORMATION OF GAS BUBBLES AND BLISTERS IN NIOBIUM DURING BOMBARDMENT WITH 0.5 TO 9 keV HELIUM IONS. Roth, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jul 1974. 50p. (In German). Dep. NTIS (US Sales Only) $5.75.

Rutherford backscattering of energetic ions combined with the channeling and blocking effects is briefly discussed as a method of determining the depth distribution of lattice defects in single crystals. A calculation model for the dependence of the backscattering intensity on the lattice defect concentration for single alignment was extended to double alignment and applied to the investigation of radiation damage in niobium single crystals due to helium bombardment in the energy range 0.5 to 9 keV and in the temperature range 150 to 1300°K. This method was used to determine the depth distribution of the lattice defects at low bombardment doses, the critical dose for blistering, the thickness of the blister covers, and the distribution of the implanted helium concentration. In the range investigated the critical dose for blistering is between 1 and 2×10^{17} He$^+$/cm^2. The depth at which helium atoms associate to form bubbles agrees with the thickness of the blister covers in all cases investigated. In random bombardment with increasing energy the depth increases from 150 Å at 1 keV to 1040 Å at 9 keV and is thus about three times as large as the calculated range of the helium ions in amorphous material. In bombardment with 4 keV helium ions in the ⟨100⟩ direction this depth decreases with increasing temperature from 720 Å at 150°K to 180 Å at 920°K. The long ranges of ions in single crystals implanted in random direction were confirmed in computer simulations. The temperature dependence of the depth at which helium bubbles form can be explained in terms of diffusion of the helium atoms, which come to rest in the undisturbed crystal lattice, and the binding of these atoms to lattice defects produced. The shape and size of the blisters were investigated in the scanning electron microscope. Bombardment in the temperature range between 150 and 1300°K produces various characteristic surface structures, some of which could not be attributed to blistering. (auth)

17493 (LA-5619-MS(Rev.)) CALCULATIONS OF LASER-INDUCED SPALL IN ALUMINUM TARGETS. Larson, A. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 39p. Dep. NTIS $4.00.

One-dimensional, plane-geometry calculations of material response to laser-target interaction are presented. The targets are homogeneous slabs of aluminum. Most calculations were done with the target in vacuum, but some investigations into the effects of having the target in air are also reported. A modified version of the CHART D code was used for the calculations. Parameters that were varied include laser-light wavelength, duration of constant-power pulses, target material thickness, and laser energy absorbed by the target. Laser energy was varied to identify thresholds at which spall occurs. As laser pulse times approach the value of two shock transit times, results revealed (1) that a large increase in energy is required for spall, and (2) that the thickness of the spalled layer increased greatly. Comparison of calculation with a single experimental result showed that spall layer thickness as calculated agrees with that measured. (31 fig) (auth)

17494 (ORNL-TM-4731) EFFECT OF NEUTRON IRRADIATION ON THE MICROSTRUCTURE AND PROPERTIES OF TITANIUM-STABILIZED TYPE 316 STAINLESS STEELS. Bloom, E. E.; Leitnaker, J. M.; Stiegler, J. O. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 20p. Dep. NTIS $4.00.

The effects of titanium additions up to 0.6 wt % on the irradiation-induced swelling and changes in creep-rupture properties were investigated. Samples were irradiated in the EBR-II at temperatures in the range 450 to 700°C to a maximum neutron fluence of 7.8×10^{26} n/m^2 (>0.1 MeV). In annealed material, the irradiation-induced swelling exhibited a minimum in the range 0.2 to 0.4 wt % Ti. The minimum in swelling was directly attributable to a minimum in the concentration of voids. Samples irradiated in the 20%-cold-worked condition exhibited slight densification at 3.0×10^{26} n/m^2 (>0.1 MeV) at both 500 and 600°C. A small density decrease (0.23%) occurred during irradiation to 6.6×10^{26} n/m^2 (>0.1 MeV). Postirradiation creep-rupture ductility was maximum for alloys containing 0.23 and 0.33 wt % Ti. The observed swelling behavior in the annealed material is thought to be associated with changing amounts of titanium and carbon in solution in the austenite as the total titanium concentration is increased. The improved ductility is attributable to a decreased tendency for grain boundary crack formation and appears to be associated with removal of sulfur and possibly other impurities from solution in the austenite. (auth)

17495 (RN-S-0237) MATERIALS IRRADIATION TEST AT-423°F. Preliminary Report GTR-16. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1965. 45p. Dep. NTIS $5.25.

Preliminary results of the second materials irradiation test conducted for the NERVA program are described briefly. Test Numbers 37/A002 (Tensile Properties) and 37/A003 (Shear Properties) are discussed. Detailed description of the tensile, shear and thermal conductivity, test plans and methods for this run is deferred until the final report. Description of the test equipment is limited to that required to explain the accuracy of the data obtained or to clarify procedural changes and decisions. Trends in changes of the mechanical properties indicate an increase of ultimate strength and a general decrease in ductility, elongation, and reduction of area for those materials that have reached a radiation damage threshold. In general, the radiation damage more seriously affected the properties of weldments than parent material, and materials of low elongation. All of the materials tested were metals and were irradiated at LH$_2$ temperature and tested at LH$_2$ temperature without warmup. The dose was 6×10^{16} nvt (E > 1.0 MeV). (12 tables, 4 figures) (auth)

17496 (RN-S-0365) REVIEW OF HIGH-TEMPERATURE RADIATION EMBRITTLEMENT OF ENGINEERING ALLOYS. Studt, P.; Dixon, C. E.; Baciarelli, R. (Aerojet-General Corp., Sacramento, Calif. (USA)). Feb 1967. 154p. Dep. NTIS $10.75.

The known characteristics and the theoretical studies of high-temperature radiation embrittlement are reviewed. This embrittlement is attributed primarily to the presence of helium, which results from the thermal-neutron ^{10}B(n,α)^{7}Li reaction; however, many details of the embrittlement mechanism are not understood. A compilation of mechanical-property radiation test data is presented for several high-temperature alloys. (auth)

17497 (RN-S-0398) FINAL REPORT ON GTR-18 TEST TO DETERMINE HIGH-TEMPERATURE RADIATION EFFECTS ON STRUCTURAL MATERIALS. Bauer, J.; Dixon, C. E.; Springer, H.; Stadig, J. E.; Weleff, W. (Aerojet-General Corp., Sacramento Calif. (USA)). Jul 1967. 63p. Dep. NTIS $6.25.

Results of Test 37/R105 in support of NERVA to determine radiation effects on structural materials containing boron are summarized. Specimens of Hastelloy X, AISI 347 stainless steel, and Inconel 625—all in the forged, welded, and thin sheet form—were irradiated in the water pool of the ground-test reactor to thermal-neutron fluences that ranged from 6×10^{17} to 1×10^{19} nvt. The specimens were tested at temperatures that ranged from 780 to 1540°F. Data on tensile properties and hardness were obtained and evaluated to determine the combined effects of radiation and temperature on the materials in their various forms. (auth)

17498 (RN-S-0401) GTR-19 TEST FOR COMPARISON OF PROPERTY CHANGES IN ALLOYS AFTER IRRADIATION IN LIQUID NITROGEN AND LIQUID HYDROGEN. Stadig, J. E.; Dixon, C. E. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1967. 30p. Dep. NTIS $4.50.

Seven structural materials—Al 6061-T6, Ti–5Al–2.5 Sn ELI, Hastelloy X, Inconel 718, A-286, and AISI 347 stainless steel unwelded and welded—were irradiated in both liquid hydrogen and liquid nitrogen to 3×10^{17} nvt (E > 1.0 MeV). Tensile properties of control and irradiated specimens were obtained and the results analyzed to establish the combined effects of radiation and temperature on material properties. (auth)

17499 (UCID-16665) DT FUSION NEUTRON IRRADIATION OF ORNL MAGNESIUM OXIDE CRYSTAL, BPNL MOLYBDENUM, LLL COPPER TENSILE SPECIMENS, LLL MACHINABLE GLASS CERAMIC, AND U. W./LLL HIGH PURITY METALLIC FOILS. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Dec 1974. Contract W-7405-eng-48. 7p. Dep. NTIS $4.00.

The requests for the irradiations in the LLL Rotating Target Neutron Source are described. The order of stacking in the metallic foils is listed. Irradiation was carried out from Nov. 7 to 13, 1974, and the average fluences from the dosimetry foils are given. (DLC)

17500 (WANL-TME-495) IRRADIATION TESTING OF AN ALUMINUM-TO-STAINLESS STEEL TRANSITION JOINT. Newby, D. J.; Freas, D. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 11p. Dep. NTIS $4.00.

Experiments were performed to prove the integrity of an Al-to-stainless steel transition joint for service in the Plum Brook Reactor Facility. A test transition joint was irradiated in the Ground Test Reactor. Results of post-irradiation tests indicate that the irradiated Bi-Braze joint can withstand the maximum combination of shear and tensile stresses expected in the PBRF W-2 loop. (DLC)

17501 (WANL-TME-1572) RADIATION EFFECTS ON INCONEL ALLOY 718. Levine, P. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1967. 77p. Dep. NTIS $7.00.

The effects of two ambient water irradiations–WANL Test 37/W402 at the Plum Brook Reactor Facility and WANL Test 37/W404 at the General Dynamics Ground Test Reactor–on the tensile properties of Inconel alloy 718 are described. The phenomena of elevated temperature annealing of fast neutron ($E > 1$ Mev) induced damage and elevated temperature embrittlement caused by the thermal neutron ($E < 0.48$ eV) $B^{10}(n,\alpha)Li^7$ reaction are related to anticipated service conditions in NERVA reactor axial support members. Irradiations to 4×10^{18} nvt (fast) have little effect on the tensile properties of Inconel alloy 718 up to 1500°R. Above this temperature, irradiations as low as 5.6×10^{17} nvt (thermal) do cause a severe loss in ductility with no effect on strength, apparently due to the transmutation of boron and subsequent embrittlement by helium at the grain boundaries. (auth)

17502 (WANL-TME-1820) FINAL TEST SPECIFICATION BERYLLIUM MATERIALS TEST 37/W406. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1968. 11p. Dep. NTIS $4.00.

Specifications for radiation effects testing of Be at –320 to 80°F are outlined. Procedures are included for specimen receiving inspection, pre-irradiation measurements, reactor operations, and post-irradiation measurements and inspections. (JRD)

17503 (WANL-TME-1820(Rev.1)) FINAL TEST SPECIFICATION: BERYLLIUM MATERIALS TEST, 37/W406. Revision one. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1968. 29p. Dep. NTIS $4.50.

Revised specifications for radiation effects testing of Be specimens at -340° to 80°F are presented. Procedures are included for specimen receiving inspection, pre-irradiation measurements, reactor operations, and post-irradiation measurements and inspections. (JRD)

17504 (WANL-TME-1820(Rev.2)) FINAL TEST SPECIFICATION: BERYLLIUM MATERIALS TEST, 37/W406. Revision 2. Coombe, J. R.; Shogan, R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1968. 35p. Dep. NTIS $4.75.

Revised specifications for radiation effects testing of Be specimens at liquid nitrogen temperature are outlined. Procedures are included for receiving inspections, pre-irradiation measurements, reactor operations, and post-irradiation inspections and measurements. (JRD)

17505 (WANL-TME-1822) FINAL TEST SPECIFICATION INCONEL-718 MATERIALS TEST 37/W410. Tubular specimens 15/W202. Stress Relaxation Specimens 15/W101. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1968. 10p. Dep. NTIS $4.00.

Specifications for radiation effects testing of Inconel-718 specimens at -320 to 740°F are outlined. Procedures are included for pre-irradiation measurements, reactor operations, and post-irradiation measurements and inspections. (JRD)

17506 (WANL-TME-1823) FINAL TEST SPECIFICATION BATH SHIELD MATERIAL TEST 37/W411. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1968. 9p. Dep. NTIS $4.00.

Specifications for radiation effects testing of shielding materials at -340 to 680°F are outlined. Procedures are included for specimen receiving inspection, pre-irradiation measurements, post-irradiation measurements and inspections, and reactor operations. (JRD)

17507 (WANL-TME-1823(Rev.1)) FINAL TEST SPECIFICATION BATH SHIELD MATERIAL TEST 37/W411 REVISION 1. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1968. 23p. Dep. NTIS $4.25.

Revised specifications for radiation effects testing of shielding materials at -320 to 680°F are outlined. Procedures are included for specimen receiving inspection, pre-irradiation measurements, reactor operations, and post-irradiation measurements and inspections. (JRD)

17508 (WANL-TME–1823(Rev.2)) FINAL TEST SPECIFICATION BATH SHIELD MATERIAL TEST 37/W411 REVISION 2. Coombe, J. R.; Shogan, R. P.; Layland, E. L.; Thomas, D. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1968. 27p. Dep. NTIS $4.50.

Revised specifications for radiation effects testing of shielding materials at -320 to 680°F are outlined. Procedures are included for specimen receiving inspection, pre-irradiation measurements, reactor operations, and post-irradiation measurements and inspections. (JRD)

17509 (WANL-TME–1824(Rev.1)) FINAL TEST SPECIFICATION SPOT WELDED TITANTIUM BANDS TEST 15/W003 REVISION 1. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1968. 14p. Dep. NTIS $4.00.

Revised specifications for radiation effects testing of spot welded titanium bands at -320°F are outlined. Procedures are included for specimen receiving inspection, pre-irradiation measurements, reactor operations, and post irradiation measurements and inspections. (JRD)

17510 WANL-TME–1901) TENSILE PROPERTIES OF IRRADIATED ALUMINUM ALLOY 2219 AT CRYOGENIC TEMPERATURES. Shogan, R. P. Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1969. 27p. Dep. NTIS $4.50.

Tensile specimens of Aluminum Alloy 2219 forging stock, and welded and unwelded sheet were irradiated at the Ground Test Reactor in test GTR-19 to a fluence of 8×10^{17} n/cm^2 ($E > 1$ MeV). The irradiation temperature was 140°R (liquid nitrogen). Properties most affected were the yield strengths which increased about 25% at 140°R for both the forging and sheet, and the total elongation which decreased by 24% for the forging. Ultimate strength and notched tensile strength were increased only slightly. Similar changes in properties were found for the welded sheet. The data show that at this fluence level the mechanical properties of the alloy would not be affected at irradiation temperature above 440°R. (auth)

17511 (WANL-TME–1901(Rev.A)) TENSILE PROPERTIES OF IRRADIATED ALUMINUM ALLOY 2219 AT CRYOGENIC TEMPERATURES. Shogan, R. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1969. 27p. Dep. NTIS $4.50.

Tensile specimens of Aluminum Alloy 2219 forging stock, and welded and unwelded sheet were irradiated at the Ground Test Reactor in test GTR-19 to a fluence of 8×10^{17} n/cm^2 ($E > 1$ MeV). The irradiation temperature was 140°R (liquid nitrogen). Properties most affected were the yield strengths which increased about 25% at 140°R for both the forging and sheet, and the total elongation which decreased by 24% for the forging. Ultimate strength and notched tensile strength were increased only slightly. Similar changes in properties were found for the welded sheet. The data show that at this fluence level the mechanical properties of the alloy would not be affected at irradiation temperatures above 440°R. (auth)

17512 (WANL-TME-2795) LOW TEMPERATURE TENSILE PROPERTIES OF IRRADIATED ALLOY A-286. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1971. 32p. Dep. NTIS $4.75.

Tensile properties of A-286 sheet were measured over the temperature range 140°R to 940°R after irradiation at 140°R to fluences from 0 to 1×10^{19} n/cm^2, $E > 1$ MeV. Results show large increases in yield strength, small decreases in ultimate tensile strength, and large decreases in uniform and total elongation after irradiation. Comparison of these results with a similar ambient irradiation indicate that cryogenic irradiation results in significantly greater property changes at comparable test temperatures. (auth)

17513 (WANL-TME–2799) LOW TEMPERATURE TENSILE PROPERTIES OF IRRADIATED INCONEL 718. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1971. 27p. Dep. NTIS $4.50.

Tensile specimens of Inconel 718 sheet were irradiated at 140°R and tested at temperatures up to 740°R. Maximum fluence obtained was 10^{19} n/cm^2, $E > 1$ MeV. Yield strengths increased below 540°R while ultimate strengths decreased slightly. A significant embrittlement also occurred at all test temperatures. However, the effects noted should not limit the applicability of the alloy over the range of test conditions studied. (auth)

17514 CURRENT-INDUCED INTERMEDIATE STATE IN SUPERCONDUCTING STRIPS OF LEAD AND INDIUM. Huebener, R. P.; Kampwirth, R. T.; Gallus, D. E. (Argonne National Lab., IL). pp 183-186 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The magnetic structure, electric conductivity, and the electrical noise power spectra in superconducting strips of Pb and In were studied. It was found that in the microstrips of In, the current-induced normal channels consist of a continuous normal domain across the strip. Liquid-like flux spots were observed in Pb films over a range of external magnetic fields strengths but not in In films. (JRD)

17515 FAST NEUTRON DAMAGE IN SUPERCONDUCTING VANADIUM. Sekula, S. T.; Kernohan, R. H. (Oak Ridge National Lab., TN). pp 217-220 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Radiation effects on magnetic susceptibility and permeability in superconducting V were studied. Data are included on magnetization and magnetic permeability before and after neutron irradiation. Flux pinning appears to be higher in irradiated V than in comparably irradiated Nb. (JRD)

17516 LOW-TEMPERATURE HEAT CAPACITY OF Nb_3Sn. Viswanathan, R. (Univ. of California, San Diego, La Jolla); Luo, H. L.; Vieland, L. J. pp 472-474 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Heat capacity measurements were made on sintered Nb_3Sn samples. Results are presented in graphs on heat capacity as function of temperature and tables on heat capacity of Nb_3Sn and related phases. (JRD)

17517 LOW-TEMPERATURE NEUTRON IRRADIATION EFFECTS IN SUPERCONDUCTING TECHNETIUM AND NIOBIUM. Brown, B. S. (Argonne National Lab., IL); Blewitt, T. H.; Scott, T.; Tepley, N.; Kostorz, G. pp 523-527 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Radiation effects on magnetic properties of Tc and Nb were investigated. The effect of the irradiation on both Tc and Nb is to increase the magnetic hysteresis remanence and the upper critical field. The pinned fluxoids escape in zero field at 6°K indicating weak pinning. (JRD)

17518 ELECTRON-PHONON ENHANCEMENT FACTOR FOR SOME TRANSITION METALS. Knapp, G. S.; Jones, R. W.; Loomis, B. A. (Argonne National Labs., IL). pp 611-614 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Specific heat measurements for Ta and Nb are used in determining the electron-phonon mass enhancement factor. The two elements were found to have approximately the same electron-phonon enhancement factor at $\simeq 0.9$. (JRD)

17519 FLUCTUATION-INDUCED DIAMAGNETISM IN BULK AL AND AL ALLOYS ABOVE THE SUPERCONDUCTING TRANSITION TEMPERATURE. Claassen, J. H.; Webb, W. W. (Cornell Univ., Ithaca, NY). pp 677-681 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature Physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Results of measurements are reported on Al, and dilute Al-Ag, and Al-Si alloys. The results support the KAE [Kurkijarvi et al., Phys. Rev., B5, 868(1972)] and LP [Lee et al., Phys. Rev., B5, 923(1972)] theories in the clean limit. (JRD)

17520 STRUCTURE OF ALPHA ZIRCONIUM DURING CREEP AT TEMPERATURES OF 500 and 600°C. Orlova, A.; Cíha, K. (Ustav Fysikalni Metalurgie, Brno). Kovove Mater.; 12: No. 1, 61-74(1974). (In Czech).

17521 EFFECT OF HIGH HELIUM CONTENT ON STAINLESS-STEEL SWELLING. Wiffen, F. W.; Bloom, E. E. (Oak Ridge National Lab., TN). Nucl. Technol.; 25: No. 1, 113-123(Jan 1975).

Type 316 stainless-steel specimens have been irradiated in the High Flux Isotope Reactor at temperatures between 380 and 680°C to displacement damage levels up to 120 displacements per atom and transmutation produced helium contents up to 6090 ppM. Swelling in solution annealed samples was found to be smaller than predicted by the helium swelling models but larger than predicted by fast reactor irradiation results, and the temperature dependence of swelling was also not in agreement with either prediction. Cold work reduced swelling for irradiation temperature up to 600 but was ineffective at 680°C. For both annealed and cold-worked materials, the swelling was nearly temperature independent between 380 and 600°C but increased markedly at 680°C. Present models are inadequate to explain the swelling results in the presence of these high helium concentrations. (auth)

17522 PECULIARITIES OF RELATION PROCESSES TAKING PLACE IN ELECTRON-IRRADIATED MARTENSITE OF CARBON STEEL. Kurdyumov, G. V.; Kritskaya, V. K. (Inst. of Physics of Metals and Metal Science, Moscow). Dokl. Akad. Nauk SSSR; 214: No. 2, 315-316(11 Jan 1974). (In Russian).

The relation changes occurring in electron-irradiated martensite of carbon steel were studied using the changes in the widths of the (011)-(110) doublet lines before and after irradiation. The samples were then held at room temperature and the changes in the doublet lines and microstrain were observed. The observations led to the conclusion that both relation and increase of microstrains take place in irradiated samples at room temperature. (JSR)

17523 EFFECT OF γ-RADIATION ON STRUCTURE AND PROPERTIES OF THIN FILMS. Korshunov, V. D.; Tarakanov, V. I. Fiz. Khim. Obrab. Mater.; No. 5, 46-49(1974). (In Russian).

The results of studies on aging in thin Cu, Ni, Ag, and V metal films by γ radiation are presented. (tr-auth)

17524 EFFECT OF HIGH-ENERGY PROTONS ON MECHANICAL PROPERTIES OF ALUMINUM. Bondarenko, G. G.; Ivanov, L. I. Fiz. Khim. Obrab. Mater.; No. 5, 151-152(1974). (In Russian).

Irradiation with 25-MeV protons to a dose of 1.6×10^{16} protons/cm^2 in the region corresponding to retardation of charged particles resulted in a marked change in the mechanical properties of aluminum. The change is related to radiation-induced damage in the microstructure of the gas-bubble and dislocation loop types. (tr-auth)

17525 INFLUENCE OF THE TRAPPING EFFECTS ON THE PHOTOCONDUCTIVITY SPECTRA OF *n*-TYPE SILICON IRRADIATED WITH FAST ELECTRONS. Petrov, V.V.; Tkachev, V.D. (V. I. Lenin Belorussian State University, Minsk). Sov. Phys.-Semicond. 8: No. 7, 916-917 (Jan 1975).

Crucible-grown and zone-grown *n*-type silicon were irradiated with electron of 10 to 30 Mev in order to measure the impurity photoconductivity spectra of the samples. (AIP)

17526 INFLUENCE OF A NEUTRON IRRADIATION AT DIFFERENT TEMPERATURES ON THE HARDENING OF IRON WITH VARYING NITROGEN CONTENT. Reimold, O. (Stuttgart Univ. (TH) (F. R. Germany)). 6 Dec 1972. 87p. (In German). INIS.

16 figs.; 54 refs. Available from the library of the Technische Univ. Stuttgart.

Single and polycrystals of iron were irradiated which had partly been doped with definite contents of nitrogen. The doped single crystals exhibit a larger effect on the yield-point changes during tempering at different temperatures as compared with the pure single crystal. The role played by nitrogen atoms in the lattice and the possible mechanisms which are the basis for the behavior in different temperature ranges are discussed. The irradiation hardening of single pure and N-doped polycrystals was investigated after an irradiation at 130°C in dependence on the neutron dose. A stronger hardening is obtained at this temperature than after low temperature irradiation, but the saturation value of the irradiation effect is influenced by the N-dopings. Measurement of the increase after irradiation hardening also shows an influence of the doping content. The discussion of the mechanisms determining the behavior considers radiation-induced nitride precipitations as well as the share of defects in the lattice. (GE)

17527 FORMATION OF SURFACE FEATURES ON NIOBIUM DURING HIGH TEMPERATURE HYDROGEN IRRADIATION. Bauer, W.; Thomas, G. J. (Sandia Labs., Livermore, CA). Radiat. Eff.; 23: No. 3, 211-212(1974).

Donhowe et al. (Nucl. Tech.; 18 : 63 (1973)) have observed 0.7 μm diameter blisters after 300-keV D^+ implantation of Nb at 700°C to doses of $\sim 1 \times 10^{19}$ D^+ cm^2. Kaminsky et al. (Rad. Effects; 18 : 245 (1973)) have observed 1 to 3 μm blisters exhibiting three-fold symmetry after 250-keV D^+ implantation of Nb at 700°C to doses ranging from 0.6 to 1.8×10^{19} D^+/cm^2. In the experiments described in the present paper, a number of Nb samples were implanted with 150-keV H^+ at temperatures from 700 to 1000°C to doses up to 3×10^{19} H/cm^2. It was found that the formation of surface features is complex and not necessarily associated with gas agglomeration effects. (auth)

17528 EFFECT OF NUCLEAR RADIATION ON MAGNETIC PROPERTIES OF HIGH-NICKEL PERMALLOYS. Artsishevskii, M. A.; Zusman, A. I.; Ulmanis, U. A. Fiz. Metal. Metalloved.; 38: No. 3, 655-656(Sep 1974). (In Russian).

The magnetic properties of high-nickel Permalloys before and after irradiation at 150°C with fast neutrons are tabulated and shown graphically. The results are discussed in light of the irradiation conditions and the preliminary processing undergone by the samples. (SJR)

Other Materials

Refer also to abstracts 16670, 17042, 17126, 17225, 17462, 18469, and 18543.

17529 (GA-5882) HOT-WORKED GRAPHITE–MATRIX FUEL BODIES. White, J. L.; Pontelandolfo, J. M. (See Code-9500489 General Dynamics Corp., San Diego, Calif. (USA). General Atomic Div.). 11 Nov 1964. Contract AT(04-3)-167. 36p. Dep. NTIS $5.00.

The feasibility of using hot-working processes to fabricate a graphite-matrix fuel body was investigated. A conventional high-temperature, gas-cooled reactor type fuel body has been found unsuitable, and the temperature limitations necessary to avoid disruption or disintegration of the fuel particles are stringent. However, by dispensing with particle coatings and by using higher matrix pitch contents to permit higher hot-working stresses at lower temperatures, graphite bodies containing either UC–ZrC or UC$_2$ particles have been hot-worked to moderate strain levels. Micrograhic observations disclose little or no disruption of the fuel particles. A limited number of property measurements have been made; the properties are consistent with those observed with hot-worked graphite containing no fuel and indicate modest improvements in strength, porosity, permeability, thermal diffusivity, and fission-product retention. (22 fig.) (auth)

17530 (LA-3122-MS) FABRICATION OF TANTALUM LOADED GRAPHITE. Schell, D. H. (Los Alamos Scientific Lab., N. Mex. (USA)). 28 May 1964. Contract W-7405-eng-36. 42p. Dep. NTIS $5.25.

Declassified 28 Aug 1973.

Graphite elements loaded with Ta were successfully extruded and processed. The finished elements were hexagonal in cross section, 3/4 in. across the flats, about 52 in. long and contained one axial hole 0.35 in. in dia. The elements were the center element in a 7-element cluster in the Kiwi nuclear rocket engines and were used to adjust the neutronic activity of the reactor. Elements were made in which the Ta loading was added to the extrusion mix as either Ta metal, oxide, or carbide. The majority of the elements contained 230 mg Ta/cc using either Ta metal or TaC as the loading material. Such elements loaded with Ta metal had C densities around 1.76 g/cc while elements loaded with TaC had remarkably high C densities of almost 1.84 g/cc. These elements were also quite strong having flexural strengths over 6000 psi. Loading curves were developed for Ta metal and TaC. (auth)

17531 (LA-3660) DEVELOPMENT OF PARTICLES COATED WITH PYROLYTIC CARBON. III. Coatings from Acetylene at Low Temperatures. Bard, R. J.; Baxman, H. R.; Savage, A. W. Jr.; O'Rourke, J. A.; McCreary, W. J.; Hayter, S. W.; Bertino, J. P.; Tinkle, M. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1966. Contract W-7405-eng-36. 41p. Dep. NTIS $5.25.

Declassified 29 Aug 1973.

Pyrolytic carbon was deposited at 1400 and 1200°C on fluidized beds of UC$_2$ particles from C_2H_2–He in a 1-in.-dia graphite coater. Coatings deposited at 1400°C at initial rates of 10 to 130 μ/h had densities in the range 1.6 to 1.8 g/cc and had poor resistance to migration at 2300°C. Coatings deposited at 1200°C at initial rates of about 4 to 20 μ/h showed good resistance to migration at 2300°C, whereas those deposited at 1200°C at lower or higher initial rates showed poor resistance to migration at 2300°C. Pyrolytic carbon deposited from 2.5% C_2H_2 at 1200°C at initial rates of 5 to 6 μ/h reorganized to an exceptional degree at 2400°C. Heat treatment at 2400°C for 3 h of a deposit of this type of pyrolytic carbon from a graphite disc coated in a fluidized bed of particles resulted in an increase of density from 1.62 to 2.25 g/cc, an increase of preferred orientation index M from 5.7 to 175, and a decrease of interplanar spacing d_{002} from 3.44 to 3.37A. Fragments of particle coatings of this type of pyrolytic carbon showed comparable densification and ordering when similarly heated. However, reorganization of this type of coating at 2400°C did not markedly improve the retention at 2500°C of molten UC$_2$–C in particles with General Atomic UC$_2$ cores unless the coating was thick enough to delaminate when cooled and unless the pretreated particles were cooled prior to testing at 2500°C. In one batch of particles with 44-μ-thick coatings of this type of pyrolytic carbon on 104- to 147-μ-dia General Atomic UC$_2$ cores, direct testing at 2500°C for 30 min exposed 42% of the uranium, whereas pretreatment at 2400°C for 3 h plus cooling resulted in only 13% of the uranium being exposed in the 2500°C–30 min test. Indications were obtained that a few percent acetone impurity in the C_2H_2 played an important role in the deposition of highly reorganizable coatings from low concentrations of acetylene at 1200°C. (9 tables, 7 figures) (auth)

17532 (LA-UR-74-1716) NEUTRON DIFFRACTION STUDIES OF DEUTERIUM SOLID STRUCTURES AND TRANSITIONS. Yarnell, J. L.; Mills, R. L.; Schuch, A. F. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 22p. (CONF-741136-1). Dep. NTIS $4.25.

From international conference on quantum crystals; Tbilisi, USSR (11 Nov 1974).

Fine-grained, randomly oriented samples of solid D$_2$ were prepared by injecting D$_2$ gas into liquid He at 4°K. Para (J = 1) concentrations of 2, 29, and 96% were used. In all cases, the as-frozen solid was predominantly fcc, with ~10% of the material in the hcp form expected at 4°K. Upon annealing at ~12°K, all samples transformed to pure hcp, and remained hcp when returned to 4°K. As expected, only the 96% para samples transformed to a cubic phase upon cooling to 1.5°K. However, the transition did not go to completion and neither holding for many hours at 1.5°K nor cycling between 1.5 and 4°K would make it do so; thus, the transition is martensitic. Analysis of the data, using cross-correlation techniques, revealed the presence of very weak, mixed-index peaks characteristic of the ordered Pa3 structure. Evidence of stacking faults (peak broadening and, for fcc, peak shifts) was seen for all structures. The average number of planes between faults was ~14 for the as-frozen fcc, ~95 for the annealed hcp, and ~27 for the Pa3. At 4°K, the molar volumes of the as-frozen fcc and the annealed hcp were the same within the experimental accuracy, and there was no observable volume change when the 2% and 29% para hcp samples were cooled from 4 to 1.5°K. These molar volumes are given by $V = 19.998 - 0.203x \pm 0.013$ cm^3/mol, where x is the para-concentration. The molar volume for the Pa3 at 1.5°K was 19.681 ± 0.007 cm^3/mol, with x = 0.96. For the annealed hcp, the c/a ratio was smaller than ideal by 1 part in 1200. For all structures, the observed intensities of the diffraction peaks were in good agreement with calculations based on wave functions for free D$_2$ molecules in J = 0 and J = 1 rotational states. (11 fig) (auth)

17533 (SAND-74-0318) SPHEROIDIZATION OF NORMAL AND DEUTERATED POLYETHYLENE. Prevender, T. S. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 12p. Dep. NTIS $4.00.

A process has been devised for making solid spherical particles of both normal and deuterated polyethylene. Spheres with diameters in the range of 10 to 10^4 microns have been made using this process. (auth)

17534 (UCRL-75727) SHOCK WAVES IN HYDROGEN ISOTOPES AND THEIR HIGH PRESSURE EQUATION OF STATE. Van Thiel, M.; Hord, B. L.; Boutwell, K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Oct 1974. 7p. (CONF-741116-2). Dep. NTIS $4.00.

From 4th international conference on high pressure; Kyoto, Japan (25 Nov 1974).

Shock wave methods for compressing liquid deuterium and hydrogen samples from 21°K and 0.15 MPa to high pressures with strong shocks are described. Both explosives and a two-stage-light gas gun were used. Although the temperatures range from 1100 to 7000°K, the data are reasonably well represented by a simple solid-state model. The small value of $\partial P/\partial E$ required to fit the high pressure data, however, suggests that the fluid is not simply diatomic under these extreme conditions. (auth)

17535 (WANL-TME–551) PRELIMINARY REPORT ON INVESTIGATION OF CEMENTED GRAPHITE JOINTS (WR 00:00:75). Harrington, G. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1963. 50p. Dep. NTIS $5.50.

Preliminary results of cemented joints tested in shear and bending are presented. Cements tested are P-509, P-510, P-511, and P-514 manufactured by Great Lakes Carbon Corporation. (auth)

17536 (WANL-TME-1260) CORROSION OF GRAPHITE BY HYDROGEN. Survey and Design of Experimental Apparatus.

Tully, T. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 41p. Dep. NTIS $5.25.

Results of tests of uncoated graphite in high-temperature flowing hydrogen are presented. Descriptions of apparatus and test procedures are included. Data on specimen weight losses at 1500, 1800, and 2000°C are tabulated. (JRD)

17537 (WANL-TME-1307) EVALUATION OF A SECOND FACILITY FOR THE THERMAL CONDUCTIVITY TESTING OF PYROLYTIC GRAPHITE. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh Pa. (USA). Astronuclear Lab.). 1 Oct 1965. 34p. Dep. NTIS $4.75.

Fifty (50) samples of pyrolytic graphite representing nine furnance lots of plate stock, all of which had been previously tested by Southern Research Institute, were tested for thermal conductivity by General Atomics, Division of General Dynamics for the purpose of evaluating their capability as a second source test facility. Seven of the nine lots had met WANL acceptance limits per Southern Research Institute test, two had not. At 1000°F, General Atomics' values varied up to 34% from Southern Research, and the average of values for furnace lots varied up to 10%. At 2000°F individual values up to 45%, and the average of lot tests varied up to 11%. The average for all fifty General Atomics' tests at 1000°F were within 1% of Southern Research while at 2000°F the average varied 9%. These variations were not significantly different from those reported by Southern Research Institute on the re-testing of Lot HM22. Test results from General Atomics would have accepted the same seven lots of material accepted on the basis of Southern Research's results, and would have subjected to rejection the same two lots. It was concluded that the General Atomics absolute steady method for determining thermal conductivity of pyrolytic graphite plate stock is reliable and well suited for WANL acceptance testing of furnace lots of raw material. (auth)

17538 (WANL-TME-1359) EVALUATION OF A PROCESS FOR MANUFACTURING AS-DEPOSITED I. D. INSULATING SLEEVES. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1966. 33p. Dep. NTIS $4.75.

Machined-all-over pyrolytic graphite insulating sleeves have been very difficult to manufacture to WANL requirements. Substantial improvements have been realized in the quality, primarily by controlling the type of microstructure and the uniformity of deposition thickness. However, many of the resulting sleeves were still not entirely satisfactory because of excessive spalling and/or intersecting delaminations. A most satisfactory evaluation was completed of a new concept manufacturing process for producing insulating sleeves of improved physical integrity. The process consisted of vapor depositing the pyrolytic graphite to the inside diameter requirements of the drawing, and machining the OD utilizing custom fitted arbors. A supplier (Super Temp Corporation) on his own initiative, conducted a test, using twelve 0.2430″ diameter graphite mandrels, to evaluate the feasibility of vapor depositing ID's to $0.245'' {}^{+.005''}_{-.000''}$ drawing dimension. No spalling or intersecting delaminations on the ID were observed, but seven of the tubes were out of the ID tolerance. An inside diameter of .246″ ±.004″ for as deposited ID sleeves was acceptable to mechanical design, making the process appear to be economically feasible. A pre-production run consisting of 312 0.2420″ ± .0005″ diameter fine grain graphite mandrels was made for evaluating the process for vapor depositing ID's to .246″ ± .004″. No spalling or intersecting deliminations of the ID was observed. There was a significant improvement in the physical integrity of the OD. Only 20% of the sleeves met the drawing concentricity requirement of .006″ maximum TIR. An O.D. machining procedure, the utilization of custom fitted mandrels, was developed which produced sleeves to the concentricity requirement. It was concluded that the ID deposited tube, machined by the custom fitted mandrel procedure resulted in improved quality insulating sleeves with a product yield at least the equal of the machined-all-over sleeve. Drawing 946C969 was created for the procurement of as deposited ID insulating sleeve hardware. (auth)

17539 (WANL-TME-1657) FRICTION TESTS OF REACTOR COMPONENT SPECIMENS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1967. 20p. Dep. NTIS $4.00.

This report is intended as a quick reference document for the designer who has a need to know the coefficient of friction for a specific combination of interface materials (graphites and coated graphite materials) for various environmental conditions. Much friction test data have been accumulated over a number of years and most have been reported in separate documents. Data from these documents and from laboratory log books have been tabulated and like type specimens grouped. (auth)

17540 (WANL-TME-1695) EFFECTS OF STABILIZATION TREATMENT ON ATJ GRAPHITE. Rahrer, G. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1967. 28p. Dep. NTIS $4.50.

Six cylindrical blanks of ATJ graphite were each divided into two samples, one of which was dimensionally stabilized by heating to 2450°C in argon for 1 h. Specimens of the stabilized and of the untreated material were prepared from these samples and various properties evaluated. Test results indicated that the stabilization treatment produced significant reductions in volatile impurities and thermal expansivity, and slight reductions in density and flexure strength, and a slight increase in electrical resistance. Calculated standard deviations indicated that stabilization also tended to reduce the variability of these properties with the exception of electrical resistance. (auth)

17541 (WANL-TME-1764) LOW-CYCLE FATIGUE IN STRUCTURAL GRAPHITE UNDER LOCALIZED LOADING. Kachur, V.; Vandergrift, E. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1968. 23p. Dep. NTIS $4.25.

In order to study the effect of cumulative damage to structural graphite loaded in tension, two commercially available grades were studied under low-cycle fatigue loading (10,000 cycles or less). The results are examined with consideration of pressing orientation and density variance. All the tests were performed on diametrally-loaded ring specimens, and give an insight into the use of this method of testing for all brittle materials which are difficult to test in uniaxial tension. Comparison of this data with the results of the more familiar modulus of rupture tests is also presented and discussed. (auth)

17542 (WANL-TME-2722) THERMAL EXPANSION CHARACTERISTICS OF UNTHERMALIZED AND THERMALIZED REROLLED PYROFOIL. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 36p. Dep. NTIS $5.00.

A comparison of the transverse thermal expansion characteristics of pyrofoil is presented. The thermal expansion of a stack of pyrofoil pieces, under an argon gas purge, was measured for a number of test builds which included all three types of pyrofoil. Some builds were assembled with a petrolatum bond to obtain the apparent thermal expansion of the wrapper under conditions expected in reactor and test hardware builds. The thermal expansion, under 10 psi loading, was obtained as a function of temperature over the complete temperature range of reactor and test hardware operation. The compaction pressure, at 4000°R, required to compress the stack to the room temperature dimension was measured as an aid to support the analysis of the core periphery wrapper cyclic strain test, 64DT-031. The greatly reduced (factor of 10) thermal expansion of the thermalized rerolled pyrofoil resulted in its use in the core periphery tests, 64DT-211 and 64DT-212. The comparative data support the use of pyrofoil as an impedance wrapper for the nuclear subsystem, NSS, core periphery. The stable thermal expansion of the thermalized rerolled pyrofoil material makes it the material having a minimum uncertainty range and, thus, most desirable for reactor application. (auth)

17543 (WANL-TME-2737) BATH SHIELD MATERIAL DEVELOPMENT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1970. 65p. Dep. NTIS $6.25.

The development of the manufacturing process and the materials properties of recent BATH (boron–aluminum–titanium hydride) round bar stock are discussed. Conventional extrusion of powder metallurgical compacts of the component powders is shown to be a practical process for producing BATH shield material which meets the program objectives for mechanical and physical properties. Optimum extrusion variables are listed. (auth)

17544 (WANL-TNR-129) HYDROGEN CORROSION TESTING OF NERVA REFERENCE FUEL. Blinn, M. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Sep 1963. 47p. Dep. NTIS $5.50.

NRX-A fuel elements have been hydrogen corrosion tested to evaluate the effectiveness of vapor-deposited NbC coatings as corrosion barriers. Data are presented to show that elements with adherent coatings survived tests at surface temperatures up to 2300°C; elements with nonadherent coatings demonstrated inferior behavior. Hydrogen corrosion characteristics of three temperature ranges are described, and mechanisms are proposed to account for the observed behavior. (21 fig, 6 tables) (auth)

17545 MICROWAVE PROPERTIES OF SUPERCONDUCTING INTERCALATED 2H–TaS$_2$. Wolf, S. (Naval Research Lab., Washington, DC); Huang, C. Y.; Rachford, F.; Chu, P. C. W. pp 442-445 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833–(P3).

Properties of TaS$_2$ in the 2H phase intercalated with pyridine [TaS$_2$ (C$_2$H$_5$N)$^{1/2}$] were studied. Experimental data on microwave absorption and dispersion as function of temperature and magnetic field strength as function of transition temperature are presented and analyzed. (JRD)

17546 TEMPERATURE INFLUENCE ON THE POLYGONIZATION PHENOMENON INDUCED ON NaCl SURFACES BOMBARDED WITH ELECTRONS AND ILLUMINATED. Arsenovici, L. C.; Teodorescu, V.; Teodorescu, I. A. (Inst. of Atomic Physics, Bucharest). Rev. Phys. Appl.; 9: No. 4, 707-710(Jul 1974).

New results are presented concerning the polygonization phenomenon in crystals heated at different temperatures from ambient to 350°C during their electron bombardment, and the studies were correlated with spectrometer measurements before and after crystal illumination. (FR)

17547 CORRELATION BETWEEN THE STRENGTH AND VICKERS HARDNESS OF SOME NUCLEAR GRAPHITE. Oku, T.; Eto, M. (Japan Atomic Energy Research Inst., Ibaraki). Carbon; 12: No. 4, 477-479(Aug 1974).

Tensile and compressive tests, Vickers and Shore hardness tests, and four point bending tests were performed at room temperature on eleven kinds of reactor graphite or high purity graphite. Correlations between strength and hardness are shown graphically. For several nuclear graphites the effect of irradiation up to fluences of 3×10^{19} n/cm^2 (>1 MeV) at 750 to 960°C in helium, on the correlation of compressive strength with Vickers hardness was also examined. The results are briefly discussed. (UK)

17548 MECHANICAL PROPERTIES OF GRAPHITES FOR HIGH TEMPERATURE GAS-COOLED REACTOR. Oku, T.; Eto, M. (Japan Atomic Energy Research Inst., Tokai). Nippon Genshiryoku Gakkaishi; 16: No. 8, 418-429(Aug 1974). (In Japanese).

A review is presented of recent investigations on the mechanical properties of graphites for HTGRs particularly the properties related to the structural design of graphite sleeves and blocks in the reactor core. Firstly, problems in the design of the structural components of the core and the properties thereof are reviewed. Then the static mechanical properties such as stress-strain curves, elastic modulus, and strength are examined, followed by a description of the irradiation creep behavior and discussion on the statistical treatment of strength and fatigue. Data are given on the essential properties required in the core design. It is noted in particular that the statistical nature of strength and fatigue offers important bases for determining design criteria, such as allowable stress. As yet, the data available on irradiation creep, strength, and fatigue are not sufficient, and further studies are being planned for the future. (auth)

17549 ELECTRON SPIN RESONANCE STUDY OF THE Ni$^+$ ION IN AN IRRADIATED KZnF$_3$ CRYSTAL. Rousseau, J. J.; Binois, M.; Fayet, J. C. (Centre Univ., Mans, France). Compt. Rend., Ser. B; 278: No. 25, 1079-1081(17 Jun 1974). (In French).

A KZnF$_3$ crystal containing various impurities including the Ni^{2+} ion, was irradiated with x rays at room temperature and then heated to 350°K. The latter treatment gives rise to ESR lines assignable to an Ni$^+$ ion in a quadratic symmetry site. (FR)

17550 LOW-TEMPERATURE SUSCEPTIBILITY MEASUREMENTS OF CERIUM MAGNESIUM NITRATE. Zimmerman, G. O. (Boston Univ.); Abeshouse, D. J.; Maxwell, E.; Kelland, D. R. pp 591-596 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The susceptibility of a CMN single-crystal sphere, a powder sphere, and a powder 1 × 1 cm cylinder were measured in zero magnetic field as a function of specific entropy by adiabatically demagnetizing the CMN from ~1°K. Effects of an external magnetic field on the susceptibility of a single-crystal sphere were also investigated. (DLC)

17551 NATURE OF THE ANOMALOUS ETCHING OF SILICON-CONTAINING HYDROGEN. Voronkov, V. V.; Savel'ev, B. N.; Voronkova, G. I.; Kobrovenskii, V. V.; Gulyamov, M. M.; Filler, A. S. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 5, 686-688 (May 1974).

Translated from Izv. Acad. Nauk SSSR, Neorg. Mater.; 10: No. 5, 801-804(May 1974).

Data and information are presented to show that hydrogen dissolved in Si is collected in vacancy pores, creating a high pressure in them. If the hydrogen concentration (C) is greater than the vacancy concentration (C$_v$), then the pressure is two orders of magnitude higher than if $C < C_v$. Anomalous etching is due to the high hydrogen pressure in the pores, which occurs when $C > C_v$. From the limiting value of C it is estimated that $C_v \sim 4 \times 10^{15}$ cm^{-3} (when the dislocation density is 10^4 cm^{-2}). (auth)

17552 SELF-INDUCED TRANSPARENCY IN EXCITONS. Krishan, V.; Krishan, S. (Indian Inst. of Science, Bangalore. Can. J. Phys.; 52: No. 21, 2127-2131(1 Nov 1974).

The interaction of intense coherent light with Frenkel excitons was studied for investigating the self-induced transparency. Some neglected nonlinear effects were included. It is found that the frequency spectrum consistent with the pulse propagation is wider by two orders of magnitude compared with the previous result. (auth)

17553 ANISOTROPY OF RADIATION STRENGTHENING OF NaCl MONOCRYSTALS. Boyarskaya, Yu. S.; Zhitaru, R. P.; Shutova, S. S. Fiz. Khim. Obrab. Mater.; No. 5, 161-162(1974). (In Russian).

Soft x irradiation of NaCl (001) and (111) faces resulted in an anisotropy of the radiation strengthening. The effect is due to the kinetics of build-up of F centers for samples with two orientations. (tr-auth)

17554 POWDER NEUTRON-DIFFRACTION DETERMINATION OF THE STRUCTURE OF Ba$_4$Sb$_3$LiO$_{12}$: THE PREPARATION AND STRUCTURE OF THE PEROVSKITE-RELATED COMPOUNDS Ba$_4$M$_3$LiO$_{12}$ (M = Sb, Bi) AND Ba$_5$M$_3$LiO$_{15-x}$ (M = Te,U). Jacobson, A. J.; Collins, B. M.; Fender, B. E. F. (Oxford Univ.). Acta Crystallogr., Sect. B; 30: No. 7, 1705-1711(15 Jul 1974).

The structure of the ordered perovskite-like compound Ba$_4$Sb$_3$LiO$_{12}$ has been determined by profile analysis of powder neutron-diffraction data. The preparation of the compounds Ba$_4$Sb$_3$LiO$_{12}$ and Ba$_5$M$_3$Li$_2$O$_{15-x}$ (M = Te,U) and x-ray evidence for their structures is described. All are found to contain only cubic stacking of AO$_3$ layers in contrast to the behavior of the analogous Nb, Ta, and W compounds. (auth)

17555 STUDY OF INFRARED ABSORPTION IN SILICON SINGLE CRYSTALS IRRADIATED WITH 50-MeV ELECTRONS. Eritsyan, G. N.; Melkonyan, R. A. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 3, 260-263(1974). (In Russian).

It is shown that the radiation defects induced in silicon by 50-MeV electrons are generally the same in the nature as those in the case of 2-MeV neutron bombardment. (auth)

17556 REDISTRIBUTION OF BORON IN SILICON AFTER HIGH–TEMPERATURE PROTON IRRADIATION. Baruch, P. (Groupe de Physique des Solides de l'E.N.S., Tour 23, 2 Place Jussieu, Paris 5e, France); Monnier, J.; Blanchard, B.; Castaing, C. Appl. Phys. Lett. 26: No. 3, 77-80 (1 Feb 1975).

We have measured the distribution of boron in silicon, using secondary ion mass spectroscopy or nuclear reactions, after irradiation at 850°C by protons of energy 250–450 keV. The fluence was 1×10^{17} to 6×10^{17} protons/cm^2. Prediffused and uniformly doped samples have been studied. It is found that the boron distribution is considerably modified: the boron concentration shows a peak near the end of the proton range, where the defect creation rate is highest. This anomaly cannot be explained by using solely simple diffusion theory, and depends on boron–defect interactions, such as the formation of precipitates or complexes. As a consequence, the interpretations of radiation–enhanced diffusion experiments must be discussed again. (auth)

17557 NEGATIVE RESISTANCE IN ION–IMPLANTED Al–Al$_2$O$_3$–Au JUNCTIONS. Hirano, M.; Kuriki, S.; Matsumoto, G. (Research Institute of Applied Electricity, Hokkaido University, Sapporo, Japan). Appl. Phys. Lett. 26: No. 3, 80-82 (1 Feb 1975).

Conduction has been investigated in Al–Al$_2$O$_3$–Au sandwiches whose oxide is implanted with O or Al ions. The results reveal that ion implantation gives a junction type which can be electroformed, and which exhibits negative resistance in air at atmospheric pressure. (auth)

17558 SPIN–LATTICE RELAXATION OF TRIVALENT URANIUM IN ANHYDROUS LANTHANUM TRICHLORIDE. Marchand, R.L.; Fish, G.E.; Stapleton, H.J. (Department of Physics and Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801). Phys. Rev. B 11: No. 1, 23-26 (1 Jan 1975).

Pulse–saturation, g–shift, and linewidth broadening data are presented for anhydrous lanthanum trichloride containing 0.01–at.% U^{3+}. The microwave frequency was 16.3 GHz. Pulse–saturation data from 1.8 to 7.3 K indicate a Raman relaxation rate which varies faster than T^9 and is anisotropic with respect to magnetic field direction. A temperature–dependent g shift, varying approximately as T^n, is observed between 19 and 29 K for a perpendicular magnetic field orientation. Relaxation–induced line broadening is observed, but only at temperatures above 25 K. (auth)

17559 EFFECT OF CRYSTAL DAMAGE ON SUPERCONDUCTIVITY IN THE TRANSITION–METAL LAYER COMPOUNDS. Tsang, J.C.; Shafer, M.W.; Crowder, B.L. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598). Phys. Rev. B 11: No. 1, 155-162 (1 Jan 1975).

The superconducting properties of the transition–metal dichalcogenides TaS_2, $TaSe_2$, NbS_2, and $NbSe_2$ have been studied as a function of structural disorder induced by heavy–ion bombardment and by deintercalation at temperatures between 300 and 800 K. Changes in T_c similar to those seen on intercalation by metal ions and organic molecules were observed but there was no increase in the anisotropy of the critical magnetic fields. The changes in T_c are attributed to changes in the electronic structure at the respective Fermi surfaces beyond previously considered changes in the density of states at the Fermi surface on intercalation. (auth)

17560 MAGNETIC AND SOME THERMAL PROPERTIES OF CHALCOGENIDES OF Pr AND Tm AND A FEW OTHER RARE EARTHS. Bucher, E.; Andres, K.; di Salvo, F.J.; Maita, J.P.; Gossard, A.C.; Cooper, A.S.; Hull, G.W. Jr. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. B 11: No. 1, 500-513 (1 Jan 1975).

The magnetic properties of all known sulfides, selenides, and tellurides of Pr and Tm (as representative of the light and heavy rare earths, respectively) have been studied. In most cases, Pr and Tm compounds exhibit Van Vleck paramagnetism at low temperatures owing to crystal–field singlet ground states. Splittings have been derived in several cases by specific–heat measurements. In the case of Pr_3X_4 (X = S, Se, Te) compounds, specific–heat and susceptibility measurements reveal exchange–induced ferromagnetism. This is further supported by the study of the magnetic phase diagrams of Pr_3Se_4–Pr_2Se_3, La_3Se_4–Pr_3Se_4, and of superconductivity in the $(La_{1-x}Pr_x)_3(S_4, Se_4, Te_4)$ series. Superconductivity persists to very high Pr concentrations, as in the $La_{1-x}Pr_xSe$ system, indicating a nonmagnetic ground state of Pr. The higher chalcogenides appear to exhibit in general semimetallic or semiconducting behavior, while most of the metallic La compounds are usually superconductors. (auth)

17561 DOSE RATE DEPENDENCE OF CARRIER MOBILITY. Gross, B. (Bell Telephone Labs., Murray Hill, NJ). Solid State Commun.; 15: No. 10, 1655-1657(15 Nov 1974).

The trap-modulated steady-state carrier mobility in insulators depends on the relation between free and trapped carriers. Under irradiation this relation changes due to the radiation-induced shift of the Fermi level. Therefore mobility is a function of dose rate. This function can be calculated when the radiation-induced steady-state conductivity is given as a function of dose rate. If the latter is given by a power law, the former is also given by such a law. (auth)

17562 RADIATION DAMAGE AND ELECTRON MICROSCOPY OF ORGANIC POLYMERS. Grubb, D. T. (Univ. of Bristol, Eng.). J. Mater. Sci.; 9: No. 10, 1715-1736(Oct 1974).

A condensed description is given of the fundamental processes involved in radiation damage and the effects of radiation on the physical and chemical properties of organic materials, particularly polymers. It is shown that the radiation doses received by specimens in the electron microscope are extremely high, very much greater than those used in radiation chemistry experiments. Because of this, only qualitative predictions of behavior in the electron microscope can be made. A number of authors have described the changes in the image or diffraction pattern of particular specimen types during observation in the electron microscope and their work is reviewed here. In general, contrast features in the image may disappear, due to loss of mass or crystallinity, or new features may appear due to distortion of ordered regions. The effects of radiation damage on attainable resolution, and possible methods of improving the resolution are then discussed. (auth)

17563 PROCESSING AND AGING OF BORON/EPOXY COMPOSITE MATERIALS. Jones, J. F. (McDonnell Douglas Corp., St. Louis); Bartels, T. T.; Fountain, R. Polym. Eng. Sci.; 14: 240-245(Mar 1974).

Batch-to-batch variations with boron/epoxy prepreg tape are described in terms of uncured and cured matrix chemistry. The effects of thermal and humidity aging on both the chemistry and tensile modulus characteristics of the epoxy matrix are also shown. (IAA)

17564 POSSIBLE INCREASE IN SUPERCONDUCTING TRANSITION TEMPERATURE IN DOPED SEMICONDUCTORS. Elesin, V. F.; Kopaev, Yu. V. (Lebedev Inst. of Physics, Moscow). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 3, 540-541(Sep 1974). Translated from Fiz. Tverd. Tela; 16: No. 3, 840-842(Mar 1974).

The effect of a strong electromagnetic field, with frequency greater than the energy gap, on the superconducting transition temperature T_c of a doped semiconductor is considered. The strong field produces a gap λ and increases the density of electron states at the Fermi level of the nonequilibrium electrons, which lies outside the gap λ in doped semiconductors. It is shown that under certain conditions T_c is increased considerably by the applied field. (auth)

17565 COLOR CENTER PRODUCTION AND LATTICE EXPANSION IN KBr BY X-IRRADIATION NEAR ROOM TEMPERATURE. Fuchs, W.; Wiegand, D. A. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem. Solids; 36: No. 1, 17-25(Jan 1975).

Nominally pure single crystals of KBr were x-irradiated near room temperature and the integrated V band absorption was studied as a function of the integrated F and F-aggregate absorption. For this relationship several stages could be distinguished during the generation of defects, suggesting that at least three different kinds of defects or disorders are responsible for the V-type absorption. The relationships of the V to F band absorption during growth and annealing suggest that the V-type centers are the complements of the trapped electron centers at least in the electronic sense. During thermal annealing, the lattice expansion produced by irradiation decreases much slower than the optical absorption, and the x-ray diffraction lines broaden. Both of these results suggest a clustering of defects, and it is postulated that the point-like F-type centers are converted into clusters. With further thermal treatment the line broadenings disappear, and other measurements indicate that all detectable disorder is annealed out around 300°C. (auth)

17566 FURTHER EXPERIMENTS ON ENERGY TRANSFER FROM BOMBARDING IONS TO Na_2O CONTAINING GLASSES. Bach, H. (Jenaer Glaswerk Schott und Gen., Mainz). Radiat. Eff.; 23: No. 3, 213-214(1974).

It was pointed out in a recent paper (Bach, Rad. Effects; 22:73 (1974)) that during ion bombardment of Na-silicate glass surfaces, the energy transfer to the target causes an angle-dependent depletion of Na near the surface and an accumulation of the Na deeper below the surface, and that there is an angle-dependent change of the amount of energy transferred from the impinging ions to Na atoms of the $Na_2O \cdot 4SiO_2$ glass in the collision cascade below the surface. An increase of energy transfer to the Na atoms sputtered which can be induced for a period of time by a change of the incident angle is connected with a decrease of the energy transfer to the network and especially for the Si atoms in the network which are sputtered from the Na-containing glass. These conclusions were drawn from observations of the emitted radiation intensity of the Si atoms and Na atoms sputtered in an excited state, using a filter with centre wavelengths of $\lambda = 461$ and $\lambda = 589$ nm respectively. Using a monochromator instead of interference filters, the luminescence induced in the glass and the photon emission of the cations in the glass which are ejected from the glass surface in an excited state during sputtering can be distinguished. The new experiments are described and results discussed. (auth)

17567 ELECTRONIC TRANSITIONS AT THE DIAMOND VACANCY. Walker, J.; Vermeulen, L. A.; Clark, C. D. (Univ. of Reading, Eng.). Proc. Roy. Soc. (London), Ser. A; 341: No. 1625, 253-266(12 Nov 1974).

The zero-phonon lines GR2, GR3, . . ., GR8 which are observed in electron-irradiated diamond between 2.8 and 3.1 eV were studied using optical absorption and uniaxial stress. The relative intensities of these lines correlate with each other and with the GR1 zero-phonon lines at 1.665 and 1.673 eV in all the crystals studied. Changes in intensity with temperature also suggest a link between GR1 and GR2 → 8. Uniaxial stress measurements indicate that GR2 (2.881 eV) and GR3 (2.888 eV) are E to T transitions at the GR1 defect. It is concluded that all the transitions GR1 → GR8 occur at the vacancy. (auth)

17568 DIFFERENCE IN CONDUCTIVITY BETWEEN LiD AND LiH CRYSTALS. Varotsos, P. A.; Mourikis, S. (Univ. of Athens). Phys. Rev., B; 10: No. 12, 5220-5224(15 Dec 1974).

The LiD and LiH conductivities have been compared in the temperature range 300 to 900°K. In both (LiD and LiH) the conductivity curve $\log_{10}(\sigma T) = f(1/T)$ shows three linear regions: (i) an intrinsic, (ii) a dissociation, and (iii) an association region. In all examined temperature ranges the conductivity values of LiD are smaller than those of LiH. The formation energy of Schottky defects is different in these two materials (2.40 and 2.33 eV, in LiD and LiH, respectively). Furthermore, the association energy of the Mg^{+2}-cation-vacancy complex is 0.76 eV in LiD and 0.84 eV in LiH; these values are unexpectedly much higher than those found in the alkali halides. Also large aggregation phenomena exist in crystals which have not undergone the usual thermal treatment. (auth)

17569 FRACTURE TOUGHNESS OF COMPOSITE MATERIALS. Iannuzzi, F. A. Knoxville, TN; Univ. of Tennessee (1974). 190p. University Microfilms Order No. 74-27,210. Thesis (Ph. D.).

It is suggested, and experimentally demonstrated for a boron-aluminum composite, that a lower bound for the stress intensity factor can be evaluated by using the composite strength and the effective critical crack at fracture in the expression from linear elastic fracture mechanics for a penny-shaped crack. The effective critical crack may be calculated from the expected number of adjacent broken fibers prior to failure estimated from the experimental strength distribution of the reinforcing fibers and available theory. The strength of carbon and boron fibers was found to obey a Weibull statistical strength distribution. Composite strengths were measured by pulling to failure straight-sided specimens of carbon-epoxy and boron-aluminum composites. In conjunction with this investigation, a fracture mechanics study was conducted on double-edge-notched carbon-epoxy and center-notched boron-aluminum composite specimens. Observations concerning the secondary effects of width, volume fraction of reinforcing fibers, thickness, fiber orientation, fiber diameter and temperature on the fracture behavior are reported. The applicability of the linear elastic fracture mechanics expressions utilized was established by compliance measurements and appropriate modifications of these expressions are suggested where deemed necessary. The load at which a crack started to grow and the load at which the specimens fractured catastrophically were measured, and observations concerning the fracture mode are reported for all specimens tested. A relationship, experimentally established, between surface crack growth and crack-opening-displacement was utilized to obtain crack resistance curves. Hence, the critical crack length necessary to initiate catastrophic fracture was determined and the critical stress intensity factors were obtained. The fracture mechanics study provides useful data concerning the behavior of the two composite systems studied and assisted in confirming the validity of the lower bound stress intensity factor calculated from the basic properties of the fibers and composites. (Diss. Abstr. Int., B)

17570 LiF DOSIMETRY. I. Optical Absorption Studies of LiF:Mg. Crittenden, G. C.; Townsend, P. D.; Townshend, S. E. (Univ. of Sussex, Eng.). J. Phys., D (London); 7: No. 17, 2397-2409(21 Nov 1974).

A detailed study of the radiation-induced optical absorption spectra in LiF:Mg:Ti reveals many more absorption features than previous work had indicated. Thermal annealing and optical bleaching were used to follow the growth and decay of at least seven optical absorption bands in the near ultraviolet spectrum between 200 and 400 nm. It is apparent that in addition to the intrinsic F, F_2 and F_3 centres there are a variety of impurity centres in the form of F_2- and Mg-related absorption bands. The identification of the bands and their role in the thermoluminescence process are discussed. (auth)

17571 LiF DOSIMETRY. II. The Effects of Mg and Ti on the Thermoluminescent Emission Spectra of LiF. Crittenden, G. C.; Townsend, P. D.; Gilkes, J.; Wintersgill, M. C. (Univ. of Sussex, Eng.). J. Phys., D (London); 7: No. 17, 2410-2421(21 Nov 1974).

The effects of Mg and Ti impurity concentrations on the thermoluminescence from LiF are discussed. The results are consistent with a model that Mg ion defects liberate electrons and Ti^{3+} ion defects emit light in emission bands at 420 and 650 mm in the process of hole capture. A consideration of the detailed processes shows that both Mg and Ti form a variety of defect complexes, and in particular one should consider the role of other impurities such as oxygen. The glow peaks are resolved by measurements of the emission spectra with emission bands occurring at 300, 420, 520 and 650 nm. The 300 nm emission involves an intrinsic defect. Emission at 520 and 650 nm is enhanced by irradiation at high fluxes. However, room temperature storage of the crystals reduced the 520 nm emission. (auth)

17572 DETERMINATION OF THE ENERGY LOSS AND ABSORBED DOSE IN POLYMERS OF ACRYLIC TYPE BY IRRADIATION IN ELECTRON BEAMS. Bratu, G.; Nicolae, M. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 10, 1075-1082(1974). (In Rumanian).

In several cases of radiation processing one of the most important problems is the accurate determination of the energy transferred to the irradiated system. A calculation model is presented for the linear energy transfer and absorbed dose in polymers of acrylic type by using the energy loss rate relations. For this purpose some physical parameters of the polymethylmethacrylate (PMMA) like Z, I (eV) A/Z were calculated and a simplified formula of the stopping power of the PMMA for electrons in the range of energy of 0.1 to 50 MeV was deduced. The values obtained for the linear energy transfer function of energy and the total energy loss in sheets of different thickness, between 0.01 to 0.25 cm are given in separate tables. From these data, the absorbed dose for this plastic in particular conditions of irradiation may be calculated. (auth)

17573 THE ALKALINE EARTH INTERCALATES OF MOLYBDENUM DISULFIDE. Somoano, R. B.; Hadek, V.; Rembaum, A. (Jet Propulsion Laboratory, Pasadena, California 91103); Samson, S.; Woollam, J.A. J. Chem. Phys. 62: No. 3, 1068-1073 (1 Feb 1975).

Molybdenum disulfide has been intercalated with calcium and strontium by means of the liquid ammonia technique. Chemical, x-ray, and superconductivity data are presented. The x-ray data reveal a lowering of crystal symmetry and increase of complexity of the structure upon intercalation with the alkaline earth metals. The Ca and Sr intercalates start to superconduct at ~4 and 5.6°K, respectively, and show considerable anisotropy regarding the critical magnetic field. (auth)

17574 PROPERTIES OF H_xTaS_2: CORRELATION BETWEEN THE SUPERCONDUCTING T_c AND AN ELECTRONIC INSTABILITY IN LAYER COMPOUNDS. Murphy, D.W.; Di Salvo, F.J.; Hull, G.W. Jr.; Waszczak, J.V. (Bell Laboratories, Murray Hill, New Jersey 07974); Mayer, S.F.; Stewart, G.R.; Early, S.; Acrivos, J.V.; Geballe, T.H. J. Chem. Phys. 62: No. 3, 967-972 (1 Feb 1975).

The preparation of H_xTaS_2 ($0 < x < 0.87$) is described. The compounds are only marginally stable at room temperature, slowly evolving H_2S and H_2 (and possibly H_2O in air). Magnetic susceptibility data show that a low-temperature transformation in 2H--TaS_2 (at 80°K) is suppressed with the addition of hydrogen, and at the same time the superconducting transition temperature T_c rises from 0.8 to ~4.2°K at $x = 0.11$. Heat capacity measurements near this concentration show the superconductivity to be a bulk effect. Finally, by correlation of this data with susceptibility and T_c measurements in other intercalation compounds, we suggest that the rise of T_c (at low electron transfer) is due to suppression of the low-temperature transformation and *not* due to an excitonic mechanism of superconductivity. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstract 16703.

17575 (REG/G-5.40(12-74)) METHODS FOR THE ACCOUNTABILITY OF PLUTONIUM DIOXIDE POWDER. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Dec 1974. 1p. DRS Free.

This regulatory guide identifies methods and criteria acceptable to the Regulatory staff for the sampling, subsampling, sample handling, dissolution, chemical and isotopic analysis, and error analysis for the accountability of plutonium dioxide powder. (TFD)

17576 (REG/G-5.42(01-75)) DESIGN CONSIDERATIONS FOR MINIMIZING RESIDUAL HOLDUP OF SPECIAL NUCLEAR MATERIAL IN EQUIPMENT FOR DRY PROCESS OPERATIONS. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Jan 1975. 7p. DRS Free.

This guide describes design features acceptable to the Regulatory staff for minimizing the residual holdup of special nuclear materials (SNM) after draindown or cleanout of equipment used in dry process operations. The design features noted will facilitate physical inventory measurements and reduce material balance uncertainties. They are not expected to interfere excessively with process operations. In particular, this guide is applicable to (1) gas handling, (2) glovebox operations, (3) calcining, (4) dry solids transfer, (5) dry blending and classification, (6) packed bed conversions, and (7) comminution. (TFD)

17577 LIMIT OF ERROR CONCEPTS AND PRINCIPLES OF CALCULATION IN NUCLEAR MATERIALS CONTROL. New York; American National Standards Institute, Inc. (1974). 8p. (ANSI-N-15.16-1974; ICONS-01810).

The phrase, limit(s) of error, has been given numerous definitions and interpretations in the literature and practice of nuclear materials control. This standard was developed to provide a definition and basic discussion of limit of error for the nuclear industry. The standard carefully distinguishes limit of error from other statistical concepts and presents a collection of guiding principles against which can be made an assessment of any proposed procedure for calculation of a limit of error. (auth)

Disposal and Storage

Refer also to abstracts 16129 and 16141.

17578 (AGC-2592) RADIOACTIVE MATERIAL HANDLING, DECONTAMINATION, AND STORAGE COMPLEX. Design Concept and Criteria. (Aerojet-General Corp., Azusa, Calif. (USA)). Jun 1963. 146p. Dep. NTIS $10.50.

This report contains preliminary data concerning the design concept and criteria for the Radioactive Materials Handling, Decontamination, and Storage Complex to be located at the Nuclear Rocket Development Station (NRDS), Jackass Flats, Nevada. (auth)

17579 (ARH-3043) WELDING DEVELOPMENT FOR THE WASTE ENCAPSULATION PROGRAM. Final Report. O'Brien, W. H. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Mar 1974. Contract AT(45-1)-2130. 39p. Dep. NTIS $5.00.

In keeping with the responsibility for management of the radioactive wastes currently generated at Hanford and the stored wastes accumulated from the past production, the Atlantic Richfield Hanford Company has built a new plant facility for encapsulation of the long-lived radioisotopes strontium-90 and cesium-137. This new plant is designed to process the stored nitrates into strontium fluoride (SrF_2) and cesium chloride (CsC_1) and seal these solid compounds in welded steel capsules for retrievable storage in deionized water basins. The storage capsules must be of the highest integrity to provide safe, reliable storage of the strontium and cesium compounds. The waste storage encapsulation process has been developed with particular emphasis on the use of optimum welding and nondestructive testing techniques. Welding development activities have been periodically reported since January 30, 1970. The latest developments in welding and testing techniques for remote encapsulation of the radioisotopes are presented. (auth)

17580 (ARH-LD-104) HIGH LEVEL WASTE CANISTER THERMAL CHARACTERIZATION FOR THE SEALED STORAGE CASK CONCEPT. Larson, D. E. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-2130. 66p. Dep. NTIS $6.50.

High level waste, generated by the chemical reprocessing of commercial nuclear reactor fuels, will be converted to a stable solid, packaged in a high integrity metal container (canister), and transferred to a Federal repository for storage. The waste and canister properties pertinent to storage require definition to assure that the filled canister will be compatible with the storage concept. The purpose of this study is to characterize the waste storage unit thermal behavior for normal and accident situations so that safe acceptance limits on heat content can be established for canisters received at the Retrievable Surface Storage Facility. The storage method used for the analyses is the Sealed Storage Cask Concept. Storage unit radiation shielding requirements for various waste and canister characteristics are also reviewed. (auth)

17581 (ARH-R-120) STRENGTH AND STRESS ANALYSIS FOR WASTE TANK STRUCTURES AT HANFORD, WASHINGTON. Final Report. Milbradt, K. P. (Illinois Inst. of Tech., Chicago (USA). Dept. of Civil Engineering). 26 Sep 1972. 62p. Dep. NTIS $6.25.

A review of the efforts to develop methods of analyses for the underground reinforced concrete tanks is presented. The transition from thin shell to finite element programs with the problems of proper constitutive relationships is considered. A method of analysis is developed using a one-dimensional non-linear constitutive relationship for the three principal stress and orthotropic material reference axes. Constant Poisson's ratios and modulus of rigidity were used in the orthotropic stress-strain relationship. The non-linear problem is solved by successive approximations using a series of linear solutions. Results are presented comparing the analyses and experimental results from the Wiss, Janney and Elstner model at 1.25 times working load and at ultimate load. Stress results for the 241-A prototype waste tanks at Hanford are presented for the static working and ultimate loads. These results indicate an ultimate load factor for structural integrity of 6.2 times the soil load over the dome. This load factor for static loading is judged to be more than adequate relative to the ACI criteria. Thermal stress fractures of the concrete plus stress corrosion cracking of the inner liner present the only mechanism for loss of containment. Results from the earthquake analysis for OBE and DBE loadings indicate no additional risk of containment loss beyond the risk associated with static loading. (auth)

17582 (ARH-R-172) ANALYSIS OF UNDERGROUND WASTE STORAGE TANKS 241-SY AT HANFORD, WASHINGTON. (Blume (John A.) and Associates Research Div., San Francisco, Calif. (USA)). Oct 1974. 97p. Dep. NTIS $8.00.

For Atlantic Richfield Hanford Co., Richland, WA.

The basic purpose of the present investigation was to determine the combined effects of long-term dead, live, and thermal loads and the safe shutdown earthquake (SSE) ground motions on the proposed 241-SY Waste Tank Structure. To analyze the structure for each of the above load conditions, an axisymmetric finite element model of the tank, with or without the surrounding soil, was used. The axisymmetric finite element model of the tank with the surrounding soils consists of shell and solid elements. Although the soil extends infinitely around the tank, the boundaries of the model were taken only sufficiently far from the tank as to affect the results of the analysis in and near the tank minimally. The model was used for the dynamic analysis of the tank-soil interaction during an earthquake as well as for the static analysis under gravity loads. An evaluation of the results indicated that the stresses in the primary steel tank were within their allowable values. The stresses in concrete and reinforcement steel of the concrete tank were also within their respective allowable values with the exception of a few localized areas. The stresses in concrete and steel reinforcement in a very small region at the dome crown exceeded slightly their allowable values. The stress in bottom steel reinforcement in the base slab near its junction with the tank wall also exceeded the allowable value though it was well within its yield strength. (TFD)

17583 (BNWL-1853) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, JULY 1974. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1974. Contract AT(45-1)-1830. 20p. Dep. NTIS $4.00.

Progress and research activities are reported on the following: storage of high-level liquid wastes; soil characteristics in Z trenches; plutonium scrap processing; tank farm support; prevention of accidental releases; groundwater management studies; environmental evaluations; and radiation standards and engineering. (TFD)

17584 (BNWL-SA-4899) METHODOLOGY FOR RISK ANALYSIS OF NUCLEAR WASTE MANAGEMENT SYSTEMS. Smith, T. H.; Winegardner, W. K.; Jansen, G. Jr.; Williams, L. D.; McSweeney, T. I. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. 25p. Dep. NTIS $4.25.

Radioactive waste is generated in a variety of forms of operations in the nuclear fuel cycle. Numerous management systems have been devised to immobilize and isolate these wastes. Such systems include multisite processing operations, transportation, and storage/disposal. Evaluation of waste management systems is a complex process. Assessments of proposed systems include technical feasibility, research and development needs, timing, cost, policy, environmental impact, and the calculated and publicly perceived safety. Risk analysis is a method of assessing the safety of proposed systems. Through such an analysis, consequences of postulated releases of radioactive material can be placed in perspective by viewing the events relative to their probability of occurrence. This paper describes a methodology for risk assessment of nuclear waste management systems. The required information and calculations are discussed, along with computer codes used for inventory calculations, fault tree evaluation, liquid and airborne transport, and dose to man. Initial application is underway for a representative conceptual system for managing high-level waste. Analysis is planned for alternatives to the reference systems and for systems handling non-high level waste. (auth)

17585 (ORNL-TM-4569) IN-SITU GAS DIFFUSION EXPERIMENTS ASSOCIATED WITH A RADIOACTIVE WASTE REPOSITORY IN BEDDED SALT. Cheverton, R. D.; Claiborne, H. C.; Evans, R. B. III. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 75p. Dep. NTIS $6.75.

The mechanical and heat transfer properties and the permeability characteristics of formations have led to recommending bedded salt as an appropriate medium for radioactive waste repositories. However, before complete acceptance of the concept can be achieved, it may be necessary to demonstrate with adequate assurance that migration of radioactive nuclides will, in fact, be acceptably small. This has been done recently for all transport mechanisms except fluid transport through interconnected porosity at the salt grain boundaries. In this report in situ gas diffusion experiments for determining the "permeability" coefficients and porosities characteristic of salt formations are discussed, and tentative criteria for acceptable migration rates for a radioactive waste repository are proposed. (auth)

17586 (RN-S-0008) RADIOACTIVE WASTE DISPOSAL FACILITY, HIGH ACTIVITY PARTS STORAGE AREA, AND SPENT FUEL STORAGE FACILITY: DESIGN CRITERIA. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jan 1964. 54p. Dep. NTIS $5.75.

This report contains data concerning the design criteria for NRDS railroad system modifications, the Spent Fuel Storage Facility, the High Activity Parts Storage Area, and the Radioactive Waste Disposal Facility (Burial), which are to be located at the Nuclear Rocket Development Station (NRDS), Jackass Flats, Nevada. This report supersedes those portions of REON Report 2592 "Radioactive Materials Handling, Decontamination, and Storage Complex Design Criteria" dated June 1963, pertaining to the facilities identified above. (auth)

17587 (UCRL-51713) ECONOMIC AND ENVIRONMENTAL EVALUATION OF NUCLEAR WASTE DISPOSAL BY UNDERGROUND IN SITU MELTING. Cohen, J. J.; Braun, R. L.; Schwartz, L. L.; Tewes, H. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Nov 1974. Contract W-7405-eng-48. 15p. Dep. NTIS $4.00.

Disposal of high-level nuclear waste by the Deep Underground Melt Process (DUMP) is reviewed and evaluated relative to other proposed methods for waste management. Although the potential environmental impact (population exposure to radiation) for the DUMP concept was found to be lower than that for alternative disposal methods, the difference is of small significance. The economic advantages, however, were substantial. A potential 80% cost savings relative to other geologic disposal methods is indicated. (auth)

17588 BURIED FOR GEOLOGICAL PERIODS OF TIME: DEEP DISPOSAL OF LIQUID WASTES. Weber, R. (Bundesanstalt fuer Bodenforschung, Hannover-Buchholz (F. R. Germany)). Umwelt; 4: No. 4, 42-43(Aug 1974). (In German).

1 fig.

A research team in Germany is in the process of investigating the possibility of burying liquid radioactive or toxic wastes in deep layers of the geological underground. The condition set here by the nature-made caves concerns the absolute separation from the hydrological cycle, so that it is impossible even over geological periods of time for the wastes to enter the biological cycle. A brief outline is given on the possibilities based on geological facts in Germany and on first tests of the burial of fluid wastes. (GE)

Handling Equipment and Procedures

17589 (AGC-2307) DESIGNING FOR REMOTE HANDLING. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1962. 297p. Dep. NTIS $18.00.

This manual discusses problems of remote handling and suggests design details for components, assemblies and systems of NERVA engines which will greatly aid remote maintenance. (auth)

17590 (CEA-CONF-2728) PROGRAMMED MANIPULATORS AND REMOTE HANDLING EQUIPMENT. Prospect for the Next Generations of Industrial Robots. Vertut, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). 1973. 12p. (In French). (CONF-731159-1). Dep. NTIS (US Sales Only) $4.00.

From conference on robots; Creil, France (8 Nov 1973).

The precise meaning of handling device is given. Manipulators devoted to industrial use are defined with regard to those used in other fields. A precise definition of the word manipulator is given. Connections between remote handling equipment and programmed manipulators (industrial robots of the first generation) are emphasized. A third stage is then studied, that of programmed manipulators constituting the specialized automatic machines or robots of the second generation. An intellectual evolution of programmed manipulators is then discussed, leading to self-adapting systems which are classified as robots of the third generation. (FR)

17591 (INIS-mf-1515) MATERIALS TESTING CELL CONTROL PANEL. Starkey, J. R. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). Nov 1973. 9p. INIS.

The materials testing cell is a hot cell housing a Hansfield tensometer, which is to be used for tensile tests on irradiated metal specimens. A small oven, mounted on the tensometer and surrounding the specimen, enables the tests to be carried out at elevated temperatures up to 800°C. The tensometer is driven by one of two electric motors outside the cell, and a load cell, attached to the tensometer, records the stress on the specimen. Test results are displayed on a chart recorder. Being very lightly loaded, the tensometer drive motor runs at constant speed, and thus the time axis of the chart record is a linear function of strain. Operation of the drive motors and control of the oven temperature are performed from the control panel, which is a 19" rack module attached to a small trolley adjacent to the cell. This trolley also carries the chart recorder and a power controller for the oven. Several auxiliary functions are also operated from the control panel. (INIS)

17592 (WANL-TME-246) HOT CELL CONFIGURATION FOR E-MAD FACILITY. Phase II. Svasek, A. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Jan 1963. 7p. Dep. NTIS $4.00.

Coments by WANL personnel on the economics of the decision to build a 6 and 6 array of hot cells in the E-MAD Facility instead of the 7 and 5 array are presented. (TFD)

17593 (WANL-TME-247) 5 AND 5 HOT CELL CONFIGURATION FOR E-MAD FACILITY. Phase II. Svasek, A. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Jan 1963. 3p. Dep. NTIS $4.00.

The position of WANL concerning a 5 and 5 array of hot cells at the E-MAD Facility is stated. (auth)

17594 (WANL-TMI-1405) CRITICALITY HAZARDS CONTROL PROCEDURE HIGH TEMPERATURE TEST ROOM ENGINEERING MECHANICS LABORATORY. Brickman, E. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1965. 28p. Dep. NTIS $4.50.

To maintain adequate criticality control within the high temperature test room of the Engineering Mechanics Laboratory, criticality control procedures have been established with reference to the Criticality Hazards Control Guide (WANL-TME-185). These procedures will assure the prevention of accidental critical assemblies by limiting the mass, establishing the geometry, or restricting the handling of enriched uranium within and between designated criticality zones. The boundaries of these zones are designated by special tape, and a detailed listing of criticality zones and the equipment contained therein is given. (auth)

17595 (WANL-TNR-171) CRITERIA OF THE POST-OPERATIVE CELLS, E-MAD FACILITY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Oct 1962. 113p. Dep. NTIS $8.75.

Information on the design requirements of the post-operative cells at the E-MAD Facility is presented. The reference operation plan, requirements for the post-operative cells, the cell service area, the warm machine shop, and the manipulator repair area are described. This report is based on the best information presently available. The reference operation plan will be changed, as required, to be compatible with the E-MAD final design and the final design of the reactor. (auth)

17596 HANDLING OF RADIOACTIVE SOURCES. Ellis, J. (to Sidney Geoffrey Young). US Patent 3,848,137. 12 Nov 1974. Filed date 9 Apr 1973. 6p.

An isotope capsule carried at the end of a radioactive source holder is handled by retracting the source holder from one position into a curved passage of a guide member through an inlet at one end of the passage, turning the guide member through an angle of less than 360° about the central axis of the other end of the passage, and then ejected through the inlet into a different position. Manipulating apparatus for withdrawing and inserting the radioactive source holder from and to a hole in a shielded transport container for the source holder and for transferring the source holder to and from a location beyond the container comprises a curved tube adapted to receive the source holder and mounted for rotation about the central axis of one of its ends so that the other end can be selectively brought into alignment with the hole in the container or with at least one guide path for the source holder externally of the container, and an operating mechanism for effecting rotation of the curved tube only in response to movement of the source holder through the operating mechanism under the influence of a remotely driven control cable attached to the source holder. (Official Gazette)

17597 RADIOACTIVE GAS DISPENSING DEVICE. Adler, N.; Morgenthau, J. L. Jr.; Gold, P. A. (to New England Nuclear Corp.). US Patent 3,848,773. 19 Nov 1974. Filed date 7 Mar 1972. 10p.

A device and method for dispensing a pre-measured amount of gas, such as a radioactive gas, contained in a sealed vial having a pierceable septum are described. A plurality of such vials are stored in an end-to-end relationship in a shielded tubular storage means. The dispensing device includes a dispenser portion having a pair of needles respectively connected to a gas dispensing adapter and displacement fluid intake adapter. One of the sealed vials is removed from the storage means and retained in a holder which is then inserted into the dispenser portion so that the septum of the vial is in a position opposite the ends of the needles. The vial is moved within the holder toward the needles so that the septum is pierced by the latter. Means are provided for injecting a displacement fluid, which in a particular embodiment may be air, into the vial through the fluid intake adapter and the needle connected thereto, thereby forcing the radioactive gas out from the vial through the other needle to the gas dispensing adapter for use in an appropriate instrument which, for example, may be a breathing apparatus, such as an oral syringe or a spirometer. (Official Gazette)

17598 REMOTE-CONTROL HANDLING DEVICE. Glachet, C.; Guilbaud, J. P.; Vertut, J. (to Commissariat a l'Energie Nuclear). French Patent 2,183,584/A/. 10 May 1972. 18p. (In French).

This manipulator comprises an arm articulated about a shoulder-axis, a forearm articulated at one extremity of said arm about an elbow-axis parallel with said shoulder-axis, and a gripper articulated about a wrist-axis at the forearm extremely opposite said elbow-axis. This manipulator is characterized in that, for achieving the motion of the arm about the shoulder-axis, the rotary motion of said arm about its axis and the motion of the forearm about said elbow-axis comprises two motors differentially-mounted so that their combined effects generate one of said motions and their differential effect generates another of said motions, and a third motor adapted to generate the third motion independently of the other two motors. (FR)

17599 MANIPULATOR WITH CONTROL MOTORS. Glachet, C.; Guilbaud, J. P.; Vertut, J.; Germond, J. C. (to Commissariat a l'Energie Nuclear). French Patent 2,183,583/E/. 10 May 1972. 18p. (In French).

Improvements in the manipulator, or handling device with control motors as claimed in the main patent are disclosed. These improvements consist in moveably mounting the arm about a shoulder axis located along a diameter of a cylindrical sleeve adapted to rotate about its axis in a holding device supporting the whole manipulator, said axis being at right angles to said shoulder and intersecting the latter. Such an arrangement permits the cancelling of the torque generated by the combined arm, forearm gripper and supporting block with respect to the axis of the body carrying these combined members, said body, in the various embodiments contemplated in the main patent, being shifted laterally, thus avoiding the need of additional balancing means, e.g., springs. (FR)

17600 CRITICALITY DESIGN OF A LARGE-CAPACITY PLUTONIUM MELTING CRUCIBLE. Schuske, C. L.; Dickinson, D. (Dow Chemical USA, Golden, CO). Nucl. Technol.; 25: No. 1, 72-82(Jan 1975).

Experimental criticality measurements have been made on assemblies of plutonium metal to design a crucible that can safely melt up to 12 kg of plutonium. In addition, in situ experiments on two prototype crucibles and furnace setups confirmed the 12-kg capacity. These crucible designs were responsible for a considerable savings in initial capital and operating expense for a new plant. A comparison of Monte Carlo calculations and experimental measurements indicated that the calculational method is sufficiently accurate to be used in future crucible designs, rather than a series of critical mass measurements. The cost for a calculational study is less than 2% of the cost of an experimental study. (auth)

Transportation

17601 (ICP-1061) SAFETY ANALYSIS REPORT FOR PACKAGING. Modified DOT Specification 6M Shipping Container for Shipment of Plutonium Nitrate USA/6643/B (AEC-ID). Lund, D. M.; Yamamura, S. S. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Dec 1974. Contract AT(10-1)-1375. 34p. Dep. NTIS $4.00.

The implementation of the USAEC sponsored Safeguards Analytical Laboratory Evaluation (SALE) Program necessitates the shipment of various nuclear materials, including plutonium nitrate solution, to the program participants throughout the world. Allied Chemical Corporation—Idaho Chemical Programs—Operations Office has the responsibility to distribute these materials to the program participants. One of the materials distributed is plutonium nitrate solution requiring a special container approved for the shipment of liquid plutonium nitrate. This report describes the shipping container which was modified and adopted for this purpose, together with the required special inner containment. The modified container, designated USA/6643/B (AEC-ID), meets the DOT and IAEA regulations for the safe transport of Type B quantities (up to 20 Ci) of plutonium as the nitrate solution. The USA/6643/B (AEC-ID) container will contain the plutonium nitrate solution under normal transport conditions or in event of accident as postulated in AECM Appendix 0529. (auth)

17602 (ORNL-TM-1312(Vol.15)) VERMICULITE SHIPPING PACKAGE: DROP TESTS ON THE CLOSURE. Jurgensen, M. C. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 21p. Dep. NTIS $4.25.

Two containers were subjected to impact tests which involved 30-ft drops onto a solid, essentially unyielding surface. The first container was dropped twice on an edge, oriented at a different angle with the impact surface each time. The second container was dropped only once, with the center of gravity located directly above the edge at impact. The results of these tests showed that the bolted closure ring served to retain the lid in all cases. (auth)

17603 CONTAINER FOR TRANSPORTING IRRADIATED FUEL ELEMENTS HAVING A HIGH RESIDUAL ENERGY. (to Commissariat a l'Energy Nuclear). French Patent 2,181,540/A/. 27 Apr 1972. 8p. (In French).

A container is described for transporting radioactive substances capable of emitting gamma and neutron radiations. A containment envelope is surrounded by a gamma protective lead sheath contained in an intermediate jacket provided with cooling members; a neutron protective outer envelope is made integral with said intermediate jacket by means of removable mechanical linkages; the outer envelope is provided with longitudinal ports for the circulation of air. The container can serve as a container for radioactive substances forming a heat source, the thermal energy of which has to be discharged into the atmosphere. (FR)

17604 DEVICE FOR THE AIR-COOLING OF RADIOACTIVE PRODUCT CONTAINERS. (to Etablissements Lemer et Compagnie). French Patent 2,179,672/E/. 14 Apr 1972. 10p. (In French).

On the container periphery, two walls contain the neutronic shield. These walls are joined by strips. These strips are welded to wall and tin-plated. Sleeve comprises several portions clamped on the tin-plated parts (or it is expanded, then clamped on the tin-plated parts). The neutronic shield (e.g., polyethylene) is introduced between the strips. The latter can be exchanged for tubes. Heat is thus transferred toward the sleeve. (FR)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 18469 and 18544.

17605 (AECL-4841) PHYSICS DIVISION PROGRESS REPORT, APRIL 1–JUNE 30, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1974. 90p. (PR-P-102). Dep. NTIS (US Sales Only) $7.50. AECL $2.00.

Tandem operations are summarized. Work in nuclear and solid state physics is reported. Some of the areas of study include the following: channeling, stopping power, magnetic multipole resonances in the Pb region, neutron spectra and angular distributions from ^{7}Li, ^{9}Be + p,d, neutron scattering, and positron annihilation. Preparation of Ge detectors was reported. Work on computer programs for fuel modeling, activity transport, hydraulics of heavy water systems, and neutron production by spallation was performed. (RWR)

For title listings of selected papers see: 18466 and 18467.

17606 (ANL/HEP-7440, pp I.1-I.12) ACCELERATED POLARIZED PROTONS AT THE ZGS. Ratner, L. G. (Argonne National Lab., IL). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

The background behind the decision to provide polarized protons in the ZGS is briefly given. Then the ZGS systems necessary for polarized proton acceleration and the measurements made of beam polarization are described. These items are treated under the following headings: polarized proton ion source and preaccelerator; 50-MeV polarimeter; machine diagnostics; special systems—pole face windings, pulsed quadrupoles; extraction from the ZGS; experimental areas; high-energy polarimeter; and results (locating the depolarizing resonances, passage through the depolarizing resonances, beam polarization measurements). (16 figures) (RWR)

17607 (ANL/HEP-7440, pp VII.1-VII.5) FUTURE OF POLARIZED BEAMS. Martin, R. L. (Argonne National Lab., IL). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

The performance of the ZGS polarized proton ion source is briefly reviewed. Then the program for continued improvement in the polarized proton beam is outlined. As the various times require varying amounts of effort, funding, etc., they are categorized as plans, gleams, and dreams. (RWR)

17608 (CONF-740522-) PROCEEDINGS OF THE IXth INTERNATIONAL CONFERENCE ON HIGH ENERGY ACCELERATORS, STANFORD, CALIFORNIA, MAY 2–7, 1974. (Stanford Linear Accelerator Center, Calif. (USA)). 1974. 786p.

One hundred thirty-nine (139) papers were presented at the conference. A separate abstract was prepared for 98 papers. The remaining 41 papers have been previously included in NSA. For abstracts of these papers see CONF-740522 in the Report Number Index. (WHK)

For abstracts of individual papers see: 16209, 17609–17626, 17639–17658, 17679–17682, 17693–17705, 17720–17757, 17763–17765, and 18051.

17609 (CONF-740522-, pp 1-6) IHEP 76 GeV PROTON SYNCHROTRON. Ado, Yu. M.; Kotov, V. I.; Myznikov, K. P.; Naumov, A. A.; Sulyaev, R. M.; Teplyakov, V. A.; Troyanov, E. F.; Zaitsev, V. I.; Zhuravlev, A. A. (Inst. for High Energy Physics, Serpukhov, USSR). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

This paper contains a brief description of the accelerator operating characteristics: the activities for increasing accelerator beam intensity, including investigation of the proton beam space charge influence upon the betatron motions, and the results of tuning secondary particles beam lines and the extracted proton beam. (auth)

17610 (CONF-740522-, pp 19-22) PROGRESS ON THE 300 GEV PROGRAMME. Billinge, R. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The tunnel has now been bored around $^3/_4$ of the machine circumference; the main magnet system is now in full production phase with 140 dipoles and 40 quadrupoles now delivered; delivery on the magnet power supply components is expected to be complete this summer; delivery of the 200 MHz traveling wave structure is expected in the autumn; the computer assisted control and beam detection system is now specified; and the injection and extraction systems are completely designed and specified. (WHK)

17611 (CONF-740522-, pp 23-31) JAPANESE 12 GEV ACCELERATOR. Nishikawa, T. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Construction of the 12 GeV proton synchrotron started in 1971 at the National Laboratory for High Energy Physics in Japan (Ko-Enerugie-butsurigaku Kenkyusho, standing for KEK). The laboratory is located at about 70 km to the northeast of Tokyo. It is one of the major institutes in the new academic town, Tsukuba, dedicated to scientific research and education. The synchrotron will be completed in 1975; its energy was planned to be 8 GeV at the first design stage but now is expected to be increased to 12 GeV by saving budget. The main parameters of the KEK synchrotron are given. The synchrotron consists of four accelerators; i.e., a 750-keV Cockcroft-Walton preinjector, a 20-MeV injector linac, a 500 MeV fast-cycling booster and a main synchrotron. (WHK)

17612 (CONF-740522-, pp 123-127) PROGRESS REPORT ON THE STANFORD SUPERCONDUCTING RECYCLOTRON. McAshan, M. S.; Rand, R. E.; Schwettman, H. A.; Smith, T. I.; Turneaure, J. P. (Stanford Univ., CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

A prototype superconducting recyclotron is being constructed at Stanford High Energy Physics Laboratory (HEPL). It is designed to accelerate electrons to an energy of 700 MeV with a beam current of 100 μA at a duty factor of unity and with an energy resolution of one part in 10^4. In recent tests the superconducting linac has achieved the following beam parameters: maximum energy 37 MeV; maximum peak current 500 μA at a duty factor of 0.33 and at an energy of 25 MeV; energy resolution (FWHM) $<5 \times 10^{-4}$ at 25 μA and 28 MeV; emittance $<1.2 \times 10^{-4}\ \pi$ mc-cm at 25 μA and $<4 \times 10^{-4}\ \pi$ mc-cm at 500 μA. Three 6-meter accelerator structures have achieved average energy gradients of ~3.0 MeV/m and Q-values of $\sim 3 \times 10^9$ with CW operation. Two of these structures have been operated with beam currents 25-200 μA for about 1000 hours without significant deterioration. The four-orbit recirculation system is under construction. (auth)

17613 (CONF-740522-, pp 151-153) 6-PASS MICROTRON USING A SUPERCONDUCTING ELECTRON LINAC. Hanson, A. O.; Harlan, J. R.; Hoffswell, R. A.; Jamnik, D.; Young, L. M. (Univ. of Illinois, Urbana). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Electrons have been recirculated six times through a 1.5 meter superconducting linac to a final energy of 19 MeV with an energy resolution of 0.1 percent. The recirculation system is based on a racetrack microtron arrangement. Novel features include active reverse magnetic field clamps at the entrances to the turn-around magnets to compensate for the vertical defocusing by the fringe fields, cylindrical lenses for vertical focusing on the return paths, and a phase adjusting bypass to guide the first return beam around the cryostat. At this time the system is operated about 40 hours per week with a three pass beam of 5 microamperes at 9.5 MeV for resonance fluorescence, photon scattering, and photofission experiments. (auth)

17614 (CONF-740522-, pp 250-253) REPORT ON THE ERA RESEARCH AT KARLSRUHE. Dustmann, C. H.; Heinz, W.;

Krauth, H.; Steinbock, L.; Zernial, W. (Inst. fuer Experimentelle Kernphysik, Karlsruhe, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

An overall review of the experiments on ERA at Karlsruhe is given. In a first part the improvements done on the injector are reported. Maximum current in the acceptance of the electron ring compressor is about 650 A with a pulse width of 8 to 10 nsec. In the second part the inflection and compression experiments are described. The maximum number of electrons inflected was higher than 6×10^{12}. Best compressed rings contained about 3×10^{12} e at a radius of R = 4 cm with minor radii of about .6 cm. (auth)

17615 (CONF-740522-, pp 254-262) OTHER COLLECTIVE METHODS. Kolomenskii, A. A. (Lebedev Physical Inst., Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

A review of the collective methods of particle acceleration is presented. The electron rings method (ERA) is not considered, and most of the other collective methods are reviewed very briefly. The main attention is paid to two new directions: "electron auto-acceleration" and ion acceleration in a gas caused by electron beam passage. The contributed papers of this session of the conference concern these methods. (52 references) (auth)

17616 (CONF-740522-, pp 263-267) PARTICLE ACCELERATION BY INTENSE ELECTRON BEAMS. Drickey, D. (Univ. of California, Los Angeles); Ecker, B.; Putnam, S. 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Further results on the process of coherent acceleration of positive particles by intense electron beams injected into an initially neutral gas are presented. Accelerating fields of the order of one MV per centimeter and proton intensities of 10^{12} protons per pulse have been observed. Proton energy as a function of cathode and gas parameters is also presented. Agreement between the beam current velocity and proton velocity is seen. Acceleration cutoff occurs in a pressure region where beam current velocity increases sharply. (auth)

17617 (CONF-740522-, pp 283-287) AUTORESONANT ACCELERATOR CONCEPT. Sloan, M. L.; Drummond, W. E. (Austin Research Associates, Inc., TX). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The autoresonant accelerator principle offers a conceptually simple and compact method for the generation of energetic pulsed ion beams in the multi-ampere current range. This accelerator scheme utilizes the lower branch of the Doppler shifted cyclotron mode of a relativistic electron beam propagating along a guide magnetic field inside a cylindrically symmetric conducting guide to serve as a traveling wave for the acceleration of ions loaded into the potential troughs of such a wave. This accelerator scheme thus combines the basic concepts of traveling wave and collective acceleration in that while a traveling wave is used for the acceleration process, this wave is a collective eigenmode of the electron beam-magnetic guide field-cylindrical guide system rather than a vacuum wave guide mode as in conventional traveling wave accelerators. A technical discussion of the accelerator and its operating parameter constraints, methods of generation of the desired eigenmode, and problem areas remaining to be investigated are presented. The equilibrium and stability requirements for the electron beam configuration are presented, and a discussion of the eigenmodes and the basic operating principles of the accelerator is presented. A method for generation of the wave is presented. An example of the performance one might optimistically expect from such an accelerator, and problem areas one might anticipate in the efficient operation of such an accelerator are briefly discussed. (WHK)

17618 (CONF-740522-, pp 304-308) PHASE-FREE ACCELERATION OF CHARGED PARTICLES BY AC FIELDS. Schott, W.; Winter, H. J.; Hagn, H.; Springer, K.; Zinner, H.; Brunner, F.; Daniel, H. (Univ., Munich). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Two methods for acceleration of charged particles that do not require a phase relation between the accelerating ac field and the incoming particles are investigated. With such a system a continuous particle beam can be accelerated. One system uses time-of-flight differences in triangular-shaped hollow electrodes on which ac voltages are applied. In the other system particles are accelerated perpendicular to an electric and a magnetic ac field whose phase difference is $\pi/2$. The time averaged energy gain of both methods is relatively small corresponding to a shunt impedance of several kΩ for electrons at small energies. In the first system the energy gain decreases with increasing particle energy whereas the energy gain for heavier particles is practically constant up to high energies (≈600 MeV for protons) in the second system. (auth)

17619 (CONF-740522-, pp 314-317) ITEP EXPERIMENTAL ASSEMBLY FOR ERA COLLECTIVE METHOD INVESTIGATIONS. Chuvilo, I. V.; Kapchinskii, I. M.; Plotnikov, V. K.; Vengrov, R. M. (Inst. for Theoretical and Experimental Physics, Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The 1.5 MeV linear induction electron accelerator with a beam current of 100 to 200 A (LIA-1.5) is described. This accelerator will be used for adjusting the compressor and other assemblies of the installation. In the future the LIA-1.5 will be replaced by a 5 MeV LIA with the beam current 2 to 4 kA. It is proposed that the main part of the experimental program will be made with this new accelerator. The main parameters of the LIA-1.5, LIA-5 and of the compressor are given. The diagrammatic drawing of the compressor and calculated time characteristic curves of the ring big radius, field on the radius of the ring and n-trajectory are shown. (WHK)

17620 (CONF-740522-, pp 318-325) PRESENT PERFORMANCE OF COLLECTIVE ION ACCELERATION IN JINR. Barabash, L. S.; Golutvin, I. A.; Dolbilov, G. V.; Ivanov, I. N.; Kovalenko, A. D.; Novikov, V. G.; Rubin, N. B.; Perelshtein, E. A.; Sarantsev, V. P.; Sviridov, V. A. (Joint Inst. for Nuclear Research, Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Throughout the last few years all the laboratories investigating and studying the collective ion acceleration method paid a great attention to theoretical as well as experimental possibilities of the accelerator. However, to come to final conclusions, a progress towards greater densities of electrons in the ring and specified experimental studies of the main effects accompanied by the electron ring formation and electron-ion acceleration are necessary. The results of the last year's studies are summarized, and it appears that one can avoid the known limitation for heavy ion accelerator using a specified scheme of the ring formation. It allowed us to start investigations of individual elements to create a prototype heavy ion accelerator and a possibility of studying the behavior of dense electron rings with ions under different conditions. (auth)

17621 (CONF-740522-, pp 480-484) CERN PS BOOSTER: DESIGN EXPECTATION CONFRONTED WITH REALITY, TWO YEARS AFTER START-UP. Reich, K. H. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

This report consists of two parts. First, the major design options of the CERN PS Booster are assessed in the light of the experience gained over the last two years. Secondly, the efforts to obtain and to preserve beam density are reported; in particular, optimization of multiturn injection, choice of the working point in the Q_H, Q_V diagram, compensation of stopbands, adiabatic rf trapping, and avoidance or damping of various instabilities. The concluding remarks contain data on the latest performance as a CPS injector, and an outlook into the future. (auth)

17622 (CONF-740522-, pp 524-528) CPS IMPROVEMENTS 1965–1973. An Assessment. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

In 1965, plans were made to increase the beam intensity delivered by the CPS by a factor of ten or more. The first stage, involving a new power supply for the main magnet and more than doubling the cycle repetition rate, was completed in 1968. In the second stage, which is now essentially complete, the major item was the construction of an 800 MeV slow-cycling booster injector. Many other modifications were included. The Linac current had to be increased by an order of magnitude to supply the Booster, and the higher beam intensities required a more powerful RF accelerating system. Besides the 800 MeV injection elements, quadrupole lenses were installed to avoid longitudinal dilution at transition, and multipoles to counteract instabilities. In addition, the chamber vacuum was improved by a factor of ten, shielding and radiation resistance increased where necessary, and beam-equipment interaction reduced. Adequate instrumentation and control facilities had to be provided, and the efficiency of fast and slow extraction systems improved. Perturbations due to various collective phenomena had to be overcome. The performance obtained during the first physics runs is reported. (auth)

17623 (CONF-740522-, pp 638-642) TRENDS OF THE DEVELOPMENT OF STRONG CURRENT CYCLIC ACCELERATORS: MESON FACTORIES. Dzhelepov, V. P.; Dmitrievskii, V. P.; Kolga, V. V. (Joint Inst. for Nuclear Research, Dubna). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

A group of scientists of the Laboratory of Nuclear Problems, JINR, has been studying 700 to 900 MeV strong current proton cyclic accelerators for meson factories. The basic results as well as the conclusions on these studies are given. The future development of this branch of accelerators has been considered on the present day level. The results of investigations on linear accelerators are compared. (auth)

17624 (CONF-740522-, pp 643-647) FIRST BEAM TESTS WITH THE 590 MeV RING CYCLOTRON AT SIN. Blaser, J. P.; Willax, H. A. (Swiss Inst. for Nuclear Research, Villigen, Switzerland). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

At the beginning of this year a few tests were performed with the SIN ring cyclotron, the first isochronous cyclotron accelerating protons successfully in CW-mode to truly relativistic energies ($\gamma = 1.63$). The extracted proton beams, though still low in intensity, were used for production of pions at an external target. The results of these early tests are presented and discussed. (auth)

17625 (CONF-740522-, pp 650-659) NEXT STEP: ACCELERATORS VERSUS STORAGE RINGS. Lederman, L. M. (Columbia Univ., New York). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

A comparative evaluation of accelerators and storage rings is made from the user's viewpoint. All possible high-energy physics experiments are reviewed, and the capabilities, advantages, and disadvantages of the Super ISR and the Super FNAL for performing these experiments are discussed and compared. It is concluded that an approximate 10 year program must include both proton storage rings and a fixed target proton accelerator. (WHK)

17626 (CONF-740522-, pp 703-766) CATALOGUE OF HIGH ENERGY ACCELERATORS. 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

An up-to-date catalog of the parameters and performance of high-energy accelerators and storage rings is presented as an appendix to the proceedings of the conference. A section listing parameters of a few new major projects that are not yet funded is also included. (WHK)

17627 (CONF-741112-5) HEAVY-ION ACCELERATOR PROJECT AT OAK RIDGE. Zucker, A.; Ball, J. B. (Oak Ridge National Lab., Tenn. (USA)). 1974. Dep. NTIS $4.00.

From fourth all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

The Oak Ridge National Laboratory is purchasing a 25-MV tandem electrostatic accelerator whose beams can be used either by themselves, or can be injected into the Oak Ridge Isochronous Cyclotron (ORIC) for further acceleration. The project includes the necessary modifications to ORIC so that these beams may be injected and further accelerated. The entire project will extend the capability to accelerate ions as high as mass 140 with sufficient energy to penetrate the Coulomb barrier of uranium. Completion is expected in about four years. (WHK)

17628 (JINR-P9-8353) MAGNETIC SYSTEM OF A COMPRESSOR FOR A COLLECTIVE ACCELERATOR MODEL. Gabanets, I.; Gurach, Kh.; Zabitskii, V. M.; Ivanov, I. N.; Kaminskaya, A. M.; Kaminskii, A. K.; Mironov, V. I.; Rashevskii, V. P.; Sarantsev, V. P.; Sergeev, A. P.; Stetsenko, S. G.; Tyutyunnikov, S. I.; Fartushnyi, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The main parameters are presented of the magnetic system of a compressor for the model of a collective accelerator of the Department of New Methods of Acceleration (JINR). The procedure is described of formation of the decreasing magnetic field on the junction of the compressor and the transition region. The principal methods for modernization of the injection system in the compressor are considered. (auth)

17629 (KIYAI-73-9) TATSIT: TANDEM-CYCLOTRON ACCELERATOR OF HEAVY IONS (Ts). Linev, A. F. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1973. 22p. (In Russian). INIS.

Different variants are considered in the use of a tandem-generator having a conductor potential of 10 MeV as an injector for a 240-centimeter isochronous cyclotron with the purpose of attaining optimal conditions for acceleration of heavy ions. An estimate is made of proposed losses of beam intensity in comparison with a cyclotron-cyclotron scheme. It is shown that a tandem-cyclotron scheme possesses a number of advantages. It is expected that with this scheme a beam of xenon-132 ions will be obtained with energies above the Coulomb barrier and an intensity of at least 10^{12} sec^{-1}. (tr-SJR)

17630 (LA-tr-72-10(Rev.)) CIRCULAR PARTICLE ACCELERATORS. Bruck, H. (Institut National des Sciences et Techniques Nucleaires (INSTN), Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1966. Translation of Accelerateurs Circulaires de Particules. 390p. Dep. NTIS $22.50.

The book is divided roughly into two principal parts: the first relating basically to betatron and synchrontron oscillations, covers subjects which are now classical while the second is concerned with more recent, and, in part, still developing matters relative to electron behavior in a circular accelerator and the problem of high intensity. Betatron and synchrotron oscillations were studied for the case of a real, i.e., imperfect, accelerator and the effect of each type of defect is carefully analyzed. The author has endeavored to make the treatment as elementary as possible while maintaining the necessary expository rigor. Among the particular problems studied in this work, which are rarely covered in similar texts, are beam scattering by residual gas and matching of long straight sections. On the other hand coupled or non-linear betatron oscillations and particularities of the fixed field alternating gradient (FFAG) accelerator theory are hardly touched upon here. The second part bears on more recent problems whose solutions occasionally, although far advanced today, still leave room for development and improvement. These are, in particular, problems with which H. Bruck has been closely associated and which are encountered in connection with electron collision (storage) rings or in investigating the possibility of obtaining high intensity beams. This part, in which the author develops his reasoning in less detail than in the first part, is addressed to more knowledgeable readers who, in particular, have carefully assimilated the developments in the first part. The author gives a systematic presentation of the effects of the radiation of the electrons on their trajectories within a circular accelerator. He uses the framework of a semi-classical theory which seems to account satisfactorily for the questions studied. The problems connected with high intensity present both collective phenomena and individual interactions between the beam particles. Our knowledge of these matters is still fragmentary in places and often right in the midst of evolving. H. Bruck's book interprets the basis of the currently known phenomena. Recent progress in accelerator theory, the construction of machines of a new type such as storage and collision rings, the existence at the present time of large projects for national or international machines, all make H. Bruck's work of great current interest. He has endeavored to make reading it easier by including reviews of mathematics or mathematical physics the reader needs: elements of matrix formalism, Floquet's theorem,..., etc. The author has obviously sought for a certain independence between the chapters, at times at the price of repetition. This gives great facility in consulting the text about one or another particular problem but on the other hand requires an extra effort for a general overview. In summary, this book complements existing treatments of the subject in an extremely valuable way and elucidates various new questions of very current interest. (auth)

17631 (NP–20281) TRIUMF ANNUAL REPORT, 1973. (British Columbia Univ., Vancouver (Canada)). Nov 1974. 62p. Dep. NTIS (US Sales Only) $6.25.

Topics include the central region cyclotron, beam dynamics, magnet, vacuum system, rf system, ion source and injection system, probes and extraction, structures and handling equipment, and the control system. Also discussed are safety, shielding proton beam lines, experimental facilities, buildings and services, the experimental program, and the organization. A financial statement is included. (WHK)

17632 (UCID-16611-1) SUGGESTIONS FOR A SUB-MICROSECOND SOFT X-RAY SOURCE. Condit, W. C.; Nowak, D. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jan 1975. Contract W-7405-eng-48. 52p. Dep. NTIS $5.75.

It is shown that synchrotron radiation can be considered for a pulsed source of high intensity soft x-ray photons by means of a combination of relativistic electron rings with megagauss magnetic field compression technology. Synchrotron radiation is usually obtained in the visible and ultraviolet spectral regions from laboratory particle accelerators, but our calculations show that the compression of electron rings (with their accompanying magnetic fields) inside imploding metal liners should allow us to make compact synchrotron sources of high intensity. The method has the advantage of being efficient (up to 25% of the energy in a capacitor bank may be convertible to photon output). It can work with existing electron beam machines in the E = 5 to 15 MeV range, unlike many pellet fusion experiments, which will generally require machines far beyond the present state of the art in energy and energy density. Finally, the proposed method provides a very flexible x-ray source, in that the 5 to 15 MeV variation in primary electron energy can provide x-ray spectra peaked at energies from about 1 to 30 keV. The total number of joules radiated depends only on the energy content of the input electron beam, being 20 times the input for efficient compression. The major uncertainty, which needs to be tested experimentally, is the requirement that the energy density of the electron ring be higher than has yet been achieved. The above possibilities lead to the proposed program. It is proposed to demonstrate feasibility of electron ring formation and compression with an existing 2 MeV, 1.5 kilojoule E-beam machine, plus a capacitor bank liner implosion system. Given the success of this first step, it would be possible to design a facility using a 50 kilojoule E-beam machine, plus auxiliary energy sources for implosion, to provide 100 kJ–500 kJ of kilovolt photon output. (auth)

17633 METHOD FOR ENERGY VARIATION OF HEAVY PARTICLE BEAMS IN LINACS. Bomko, V. A.; Klyucharev, A. P.; Rudyak, B. J.; Khizhniak, N. A. (Physico-Technical Inst., Kharkov). Particle Accel.; 6: No. 1, 1-5(1974).

A method is described for achieving continuous variation of the energy of the beam accelerated in a linear accelerator. This is accomplished by accelerating with a higher order mode than the one ordinarily used. The mode used has at least one node in its axial field pattern. Beyond the node the field is reduced to zero by introduction of a stub through the end wall of the cavity. Procedures for varying the position of the node which terminates the accelerating field are described. (auth)

17634 LINEAR ACCELERATOR EMPLOYING AN ELECTRODYNAMIC SPACE CHARGE EFFECT. Heese, N. R. Montreal; Sir George Williams Univ. (1973). 68p.

Thesis.

A simple linear accelerator for electrons was built and is now in operation. The acceleration is accomplished by an electrodynamical space-charge effect in a cylindrical electron beam, by virtue of which the energy of the beam is transferred to the front electrons. The 7 ft.-long instrument, operated with a 20 keV, 350 mA beam, produces electrons of energies up to 14 MeV. Design and operational characteristics are presented along with the results of performance tests. (auth)

17635 WORLD'S LARGEST PROTON ACCELERATOR TAKES SHAPE. Persson, L. Tek. Tidskr.; 104: No. 11, 47-48; 51; 55(7 Jun 1974). (In Swedish).

The European Organization for Nuclear Research, established in Geneva, decided in February 1971 to build such an accelerator at a cost of 1150 million Swiss francs over an 8-year period. In something over three years the number of persons directly or indirectly employed by this organization (CERN) has risen to around 4700, including around 80 from the Swedish universities of Gothernburg, Lund, and Stockholm, and from research establishments in Uppsala and Studsvik. The project will provide for a maximum proton energy of 400 GeV, an intensity of 10^{13} protons per pulse, and an accelerator step frequency of 200 MHz. The accelerator is located 40 m underground in a circular tunnel with a circumference of 6.9 km. A large assembly hall, laboratory buildings, and research departments were taken into operation in 1973. More than half the accelerator tunnel is already bored out and the steel transport tunnels are blasted out to the extent of 80%. (SW)

17636 CALCULATION OF SECTIONAL SOLENOID SYSTEM PARAMETERS BY MEANS OF A DISPLAY. Borovik, E. P.; Privezentsev, A. P.; Protasevich, E. T.; Tarasov, V. M. pp 40-43 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper proposes a method of designing the magnetic system of an auto-resonance, electron accelerator by means of a display. Designing is carried out with the use of a display processor consisting of a BESM-4 computer, oscillograph with an electrostatic tube and a light pencil. A block diagram of the design program is presented. The method is illustrated by design of a solenoid as an example. (tr-SJR)

17637 FACILITY FOR EXPERIMENTAL STUDIES ON CHARGED PARTICLE ACCELERATION IN SMOOTH WAVEGUIDES BY MEANS OF FAST ELECTROMAGNETIC WAVES IN AN INCREASING MAGNETIC FIELD. Panichkin, Yu. V.; Protasevich, E. T.; Shtejn, Yu. G. pp 38-40 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes an experimental unit for investigating charged particle acceleration in smooth waveguides by fast electromagnetic waves in a rising magnetic field. The unit includes a high-frequency system, an injector, vacuum pumps and equipment for controlling the unit. The constant magnetic field, which rises along the length of the accelerating waveguide, was created by means of a solenoid, consisting of 15 sections, in correspondence with the change in strength of the magnetic field. In order to investigate the form of the accelerated beam a target covered with a luminophore was placed at the exit of the accelerating waveguide. The study showed that in the presence of a rising magnetic field, acceleration is observed over the entire length of the accelerating waveguide. (tr-SJR)

17638 NANOSECOND HIGH-CURRENT ACCELERATOR TONUS. Glejzer, I. Z.; Didenko, A. N.; Dronova, L. P.; Kotlyarevskij, G. I.; Okulov, B. V.; Pak, V. S.; Remnev, G. E.; Rudenko, N. S.; Tuzov, V. A.; Smetanin, V. I.; Usov, Yu. P.; Shatanov, A. A.; Zherlitsyn, A. G. pp 86-89 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes construction features, and presents a number of characteristics of a nanosecond electron accelerator at Tomsk Polytechnical Institute. The accelerator consists of a 2.2 MV Marx generator, a doubly formed line with oil filling, diode with a single-emission cold cathode and a drift tube. The electron beam "Tonus" includes sectioned insulation, a cathode-holder with a multi-needle cathode, an anode unit with recorders for measuring voltage and current, and a drift tube with a solenoid for creating a longitudinal magnetic field. The accelerator operates in the following mode: energy of 1 MV, current of 40 kA, and a pulse duration of 40 nsec. (tr-SJR)

Auxiliaries and Components

Refer also to abstracts 16445 and 18669.

17639 (CONF-740522-, pp 115-122) RF SUPERCONDUCTIVITY. Kuntze, M. (Univ., Karlsruhe, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Superconductors used for the microwave accelerating structures held the promise of a drastic reduction in rf power requirement at comparable or higher field strengths with respect to conventional ones. Technically applied accelerating structures have sufficiently low rf losses at high fields, whereas the maximum achievable rf field is still below expectations. However, the theoretical limit for the rf field has nearly been reached in some test resonators at a laboratory scale. Further improvement in high rf fields is expected. (52 references.) (auth)

17640 (CONF-740522-, pp 128-132) APPLICATION OF SUPERCONDUCTING RF ACCELERATING SECTIONS TO AN ELECTRON SYNCHROTRON. A Progress Report. Sundelin, R. M.; Kirchgessner, J.; Padamsee, H.; Phillips, H. L.; Rice, D.; Tigner, M.; von Borstel, E. (Cornell Univ., Ithaca, NY). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Efforts to apply superconducting rf accelerator technology to an electron synchrotron are described. Using a 60 cm length of an open type of π-mode structure operating at S-band, a beam has been stably accelerated to 2 GeV in the Cornell Electron Synchrotron. Characteristics of the rf accelerator are described and the results of the first beam tests are given. Problems revealed by these tests are listed. (auth)

17641 (CONF-740522-, pp 140-142) BREAKDOWN FIELDS IN A SUPERCONDUCTING NIOBIUM CAVITY AT S-BAND. Kneisel, P.; Lyneis, C.; Stoltz, O.; Halbritter, J. (Univ., Karlsruhe, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The measurements of the rf breakdown and its localization in different modes of an S-band niobium cavity gave new insight about the thermal magnetic breakdown, especially the TE_{011} mode, where the initial peak rf field of 810 Oe deteriorated to about 400 Oe after the cavity has been subject to the electron loading of TM modes causing surface damage. After damaging the surface by electron impact at He temperatures, the field level in all modes is limited to about 400 G. For TM modes this field level corresponds to a surface electric field of about 25 MV/m. (auth)

17642 (CONF-740522-, pp 143-146) ON THE PREPARATION AND A THERMAL BREAKDOWN MECHANISM OF SUPERCONDUCTING NIOBIUM X-BAND CAVITIES WITH HIGH MAGNETIC FLUX DENSITIES. Hillenbrand, B.; Martens, H.; Schnitzke, K.; Diepers, H. (Research Labs., Siemens AG, Erlangen, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Performing only a surface treatment of Nb-X-band cavities we could obtain high magnetic breakdown flux densities B_c^{ac} up to 159 mT (TE_{011}-type) and 149 mT (TM_{010}-type) with high field Q values in the order of 10^{10}. The preparation consists of electropolishing, oxipolishing and, in many cases, a final anodizing, but includes no degassing. For oxipolishing special conditions are reported to prevent the formation of gray stains. Thus prepared surfaces are stable against degradation by gas exposure even if not anodized. B_c^{ac} values of 100 mT and more could be reached with different materials (coarse and fine grained), but not with cold worked niobium. We repeatedly observed a strong temperature dependence of B_c^{ac} which we interpret as a thermal breakdown independent from the critical fields of superconducting niobium. Calculations on the basis of this mechanism are carried out and compared with experimental results. (auth)

17643 (CONF-740522-, pp 147-150) SUPERCONDUCTING RF CAVITY WITH REACTIVELY SPUTTERED NIOBIUM NITRIDE SURFACES. Isagawa, S.; Kimura, Y.; Kojima, Y.; Mitsunobu, S.; Mizumachi, Y. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

A technique to make a superconducting rf cavity with niobium nitride (NbN) surfaces has been developed. Niobium nitride is deposited on inner surfaces of Al and Nb cavities by the reactive dc sputtering method. The sputtering is performed by applying high voltage of about 5.2 kV between a Nb cathode and a Cu or Nb anode in an atmosphere of N_2 and Ar. The deposited NbN film is about 5 μm thick and shows a critical temperature of about 15°K. A preliminary Q measurement for a C-band NbN cavity of TE_{011} type gives $Q = 0.9 \times 10^7$ at 4.2°K. (auth)

17644 (CONF-740522-, pp 164-169) SUPERCONDUCTING MAGNETS. Thomas, D. B. (Rutherford Lab., Chilton, Eng.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

An overview of the present state of knowledge in superconducting magnet technology is presented. (WHK)

17645 (CONF-740522-, pp 174-178) PULSED SUPERCONDUCTING DIPOLE MAGNETS OF THE GESSS COLLABORATION. Turowski, P. (IEKP, Karlsruhe, Ger.); Coupland, J. H.; Perot, J. 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The three laboratories of the GESSS Collaboration have constructed dipole magnets which approach synchrotron conditions, all show a field homogeneity of a few parts in 10^3 up to a field level of 4.5 T, and are capable of a rise time of at least 5 seconds with losses less than 20 W/m at a rise time of 10 seconds. For the next magnets the changes in designs are mainly towards a more homogeneous thermomechanical structure to overcome training effects, which are seen as the main problem of superconducting magnets today after meeting the requirements for field homogeneity. (auth)

17646 (CONF-740522-, pp 204-208) PREDICTION OF RADIATION EFFECTS ON ACCELERATORS USING HADRON CASCADE CALCULATIONS. Ranft, J. (Karl-Marx-Univ., Leipzig). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Radiation effects, especially radiation heating, radiation doses and induced activities on accelerator components as septa, targets, beam dumps and accelerator and beam line magnets are predicted using hadron cascade calculations. There is good agreement to measurements in the 10 to 20 GeV energy range, the same is found in a comparison to first measurements as 300 GeV at NAL. (auth)

17647 (CONF-740522-, pp 209-213) RESEARCH WORK ON PULSED SUPERCONDUCTING MAGNETS FOR ACCELERATORS. Alexeev, V. P.; Vasiliev, A. A.; Galstyan, E. A.; Greben, L. I.; Mironov, E. S. (Radiotechnical Inst., Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Research work on precise and reliable superconducting magnets for accelerators is presented. Accelerator magnet requirements, design, and related topics are considered. Some features of superconducting magnets usage in high-energy accelerators are discussed. (auth)

17648 (CONF-740522-, pp 297-300) SECOND HARMONIC RF ACCELERATION ON NIMROD. Sandels, E. G.; Gardner, I. S. K. (Rutherford Lab., Chilton, Eng.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The possible beam intensity improvement for Nimrod by the use of two rf cavities operating at harmonic numbers h and 2h for the acceleration of protons has been computed and the optimum accelerating field amplitudes and phases obtained. The rf power circuits, the drift tube and the ferrite tuning system have previously been described. Subsequently high voltage biasing plates, along the vertical internal walls of the straight section box containing the drift tube, were added to suppress multifactoring. The low power rf electronic circuits and the commissioning of the complete system are described. (WHK)

17649 (CONF-740522-, pp 301-303) ACCELERATING WAVEGUIDES FOR HIGH-ENERGY ACCELERATORS. Shalnov, A. V. (IAEA, Vienna). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Accelerating waveguides are used for both high-energy and low-energy electron accelerators and can also be applied to synchrotrons. High-energy synchrotrons have a very narrow frequency band (due to the high energy of injection), use a high frequency supply and require a significant energy gain per turn and therefore non-tuned accelerating waveguides can be used. This application was proposed at CERN and then was extended to high intensity accelerated beams. For the last case, heavy beam loading, bunched in an equilibrium phase, must be taken into account. Uniform waveguides are considered and some recommendations from the energetical point of view are discussed. Some general remarks are made concerning non-uniform waveguides. (auth)

17650 (CONF-740522-, pp 390-393) ACCELERATION BY PHASE DISPLACEMENT IN THE ISR. Henrichsen, K. N.; de Jonge, M. J. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Acceleration by phase displacement is used in the ISR to accelerate stacked protons from 26 GeV/c to 31.4 GeV/c. In the phase displacement process empty rf buckets are moved through the stack from higher to lower momentum which results in a shift of the stacked beam towards higher momentum. The total momentum shift is determined by the available rf voltage, the stable phase angle ϕ_s and the number of passages of the empty buckets through the stack. The stable phase angle ϕ_s should be as small as the time and rf noise permit, in order to reduce the dilution of longitudinal phase space density inherent in the process. One of the main difficulties encountered was the synchronization of the magnetic field adjustments and the rf system. Twenty-six power supplies are adjusted simultaneously by the control computer in order to keep the betatron frequencies constant during the acceleration. To reduce losses resulting from beam-beam effects, the betatron frequency band used must be free of resonances and the beams have to be separated in the intersections during acceleration. (auth)

17651 (CONF-740522-, pp 490-494) USER'S ASSESSMENT OF THE COMPUTER CONTROLS SYSTEM OF THE CERN PS BOOSTER. Baribaud, G.; Benincasa, G.; Daneels, A.; Heymans, P.; Metzger, C.; Pedersen, F.; Rabany, M.; Schindl, K.; Stark, J. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The CERN PS Booster (PSB) was designed to be completely computer-controlled and no manual backup was foreseen. The physical construction of the four-ring PSB necessitates simultaneous operation of different parts of the accelerator and therefore requires a multi-entry software facility. A significant feature of this facility is the data base, which links the software to the hardware of the accelerator and also leads to an increase in the versatility of tests and operation. The evolution of the system from its conception, through the phases of commissioning and running-in, each with its different needs, to the present operational stage is described. Attention is drawn to the lessons that have been learned during the first two years of exploitation. The initial phases were made more difficult because it was impossible to separate completely effects due to the commissioning of the controls system and the first tests of the accelerator. However, the investment in this first phase gave rise to substantial benefits as soon as basic settings for the PSB were found. The current phase of operation typifies some of the problems involved with simultaneous development of a machine and its computer-controls system. (auth)

17652 (CONF-740522-, pp 495-498) USE OF A GENERAL-PURPOSE TIME-SHARED COMPUTER IN ACCELERATOR CONTROL. Barton, M. Q.; Culwick, B. B.; Curtiss, J. A.; Dabrowski, J. J.; Frankel, R. S.; Harrison, W. E.; Martin, F. R.; Smith, J. D.; Warkentien, R. J.; Weitman, I. (Brookhaven National Lab., Upton, NY). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

A general purpose real-time data acquisition and control system implemented on a PDP-10 time shared computer and interfaced to devices via PDP-8 peripheral processors and a serial transmission scheme has been constructed for the Brookhaven AGS. The design objectives of Fortran coded time-shared access to the accelerator have been achieved under the manufacturer's monitor with the addition only of shareable device handlers. The time-sharing monitor has allowed the development and operation of alternative control systems in parallel with continued use of an earlier system. Program development has been facilitated by the convenient access provided by the operating system and the multiple terminals available for programming and testing. (auth)

17653 (CONF-740522-, pp 499-502) OPERATOR INTERFACE OF THE 300 GeV ACCELERATOR. Beck, F. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The new CERN accelerator is controlled through a large computer network with the help of a specially designed real-time interpretive language. This has enabled the problem of designing an operator interface to be separated from that of producing control mechanisms. The paper discusses this interface, and some of the facilities which it will provide for machine operators. (auth)

17654 (CONF-740522-, pp 503-507) COMPUTER CONTROL SYSTEM FOR THE SPS. Hyman, J. T. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The aim in the design of the control system for the SPS has been to give the operators and machine physicists an integrated system capable of providing sophisticated control facilities but yet retaining simplicity of use for normal operations. Twenty-four minicomputers are used in the system with CAMAC input/output and a fast multiplex system to provide the interface to the SPS equipment. The intercomputer communication is over serial data links through a store and forward message transfer system. The software is based on the use of an interpreter in conjunction with a small real-time executive. A comprehensive addressing scheme, with segmented data tables, is used in preference to a large monolithic structure. (auth)

17655 (CONF-740522-, pp 511-515) DIGITAL CONTROL OF RECTIFIER FIRING ANGLES FOR THE ZERO GRADIENT SYNCHROTRON (ZGS) RING MAGNET POWER SUPPLY. Knott, M. J.; Lewis, L. G.; Rabe, H. H. (Argonne National Lab., IL). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The heart of the new control system for the ZGS ring magnet power supply is a counter that counts from 0 to 3600 each voltage cycle of the main generator. This provides an electrical degree scale that is synchronized with the generator voltage wave by a phase-lock feedback loop. Digital gates compare the number in the counter with the desired angle for firing each of the 12 rectifier phases. At equality, a pulse is generated and applied to the control grids of the appropriate mercury vapor rectifiers. Fast digital arithmetic adder circuits update the desired firing angles for each of the 12 phases in response to commands from the ZGS programmer and in response to feedback signals from beam spill monitors and from B pickup coils on the ring magnet. Separate digital arithmetic adders and selectors provide individual adjustment of each phase in order to reduce low frequency ripple. This system has greatly reduced 50-, 100-, and 150-cycle ripple on the ring magnet field on flattop and on porches, has provided fast action to permit spill control when the rf accelerating cavity is off, and has provided stable operation in full rectification for the accelerating part of the ZGS cycle. (auth)

17656 (CONF-740522-, pp 521-523) INITIAL EXPERIENCE WITH A MULTI-PROCESSOR CONTROL SYSTEM. Mallory, K. B. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The SLAC accelerator has now been controlled through a system of two linked computers for a year. In the first four months of 1974 nine additional CPU's have been linked into the system. Figure 1 shows the present configuration. It is time to review the problems encountered in computer-control of the accelerator and to discuss their solutions—installed, pending and proposed. (auth)

17657 (CONF-740522-, pp 576-583) SLED: A METHOD OF DOUBLING SLAC'S ENERGY. Farkas, Z. D.; Hogg, H. A.; Loew, G. A.; Wilson, P. B. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The design and theory of operation of a proposed rf system using overcoupled cavities (called SLED) for doubling the energy of the

SLAC beam are discussed. The operating parameters and possibilities of the system are described. (WHK)

17658 (CONF-740522-, pp 610-614) MAIN RING MAGNET SYSTEM OF KEK PS. Ando, A.; Endo, K.; Kasuga, T.; Kihara, M.; Takasaki, E. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Results of the field measurement on the quadrupole and bending magnets for the main ring of the KEK 12 GeV proton accelerator are shown. The design of secondary magnets is reported. (auth)

17659 RF LOSSES AND PEAK FIELDS IN HELICAL RESONATORS. Polchinski, J. G.; Jancaitis, K. S.; Tombrello, T. A. (California Inst. of Tech., Pasadena). Particle Accel.; 6: No. 1, 57-61(1974).

To provide reliable estimates of the peak fields and rf losses in a helically loaded resonator, we first obtain the basic electromagnetic fields in the cavity with a modified sheath model. Using a quasi-static, two-dimensional analysis and a conformal transformation, the enhanced fields on the helix wire are calculated. The present calculations are an improvement on an earlier paper, in that a mapping which more accurately represents the shape of the helix wires is used. The results of these calculations are compared with the experimental data of Bendt, Erkkila and Stokes (IEEE Trans. Nucl. Sci., NS-20, No. 3, 185 (1973)). It was found that the cooling efficiency may be improved appreciably by using wire with a noncircular cross section. (auth)

17660 COILS WITH INORGANIC INSULATION AND THEIR APPLICATION IN RESEARCH MAGNETS. Rauch, J. C.; Violi, E. Brown Boveri Rev.; 61: 512-516(Nov 1974).

Electromagnets used in particle accelerators and their experimental areas for focusing and deflecting charged particles are subject to intense radiation. Organic materials particularly are destroyed by this radiation; in the case of magnets this means mostly the organic insulation of the excitation coil. An alternative method of insulating these coils is described with special reference to a magnet of purely inorganic components produced for the Swiss Institute for Nuclear Research. (auth)

17661 CONTINUOUSLY DISPLAYED EMITTANCE MEASUREMENTS. Billen, J. H. (Univ. of Wisconsin, Madison). Rev. Sci. Instrum.; 46: No. 1, 33-40(Jan 1975).

A device is described to display continuously on a CRT the emittance of an ion beam. The system uses electrostatic deflectors and small apertures to scan the beam's phase-space position and momentum coordinates. Measurements are reported of the emittance and brightness of the following beams produced by five different ion sources: H^-, D^-, He^+, He^-, C^-, D_2^-, O^-, NH_2^-, A^+, and Cu^-. Also investigated was the emittance of an H^- beam from a duoplasmatron direct-extraction source as a function of the radial displacement of the zwischen electrode, and the phase-space particle density distribution of an H^- beam was measured. (auth)

17662 CHARGED PARTICLE BEAM SCANNING DEVICE. Constantinescu, A.; Marghitu, S.; Teodorescu, I. E. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 5, 469-477(1974). (In Rumanian).

The fabrication of a beam scanning system is discussed. It consists of two mechanically coupled electrodes accomplishing movements of translation in both X and Y directions of one transverse plane, with constant spread. With respect to other beam scanners (having rotating or vibrating electrodes), the above mentioned features make it possible to use the system not only as a beam profile monitor, but also as an instrument for precise measurements of the scanned beam parameters. When used as a beam current meter, it is shown that the indication is independent of the density distribution or the beam profile contour. The system acts as quasi-transparent average beam current measuring instrument. Density distribution in the beam cross section can be estimated by comparing the electrode signal pulse shapes, as shown in the presented examples. In order to perform precise, quantitative density distribution or beam-emittance measurements, the systems may be completed with a diaphragm having a number of small diameter holes, allowing a spatial sampling of the beam, along the two scanning directions. (auth)

17663 ENERGY MODULATION OF PROTON LINAC BEAMS. Kapchinskii, I. M.; Bobylev, V. I. At. Energ. (USSR); 37: No. 5, 393-395(Nov 1974). (In Russian).

A device capable of simultaneously debunching and modulating the mean particle energy during an ion pulse of a linear accelerator is described. It is assumed that the change in mean energy is performed by a modulated resonator excited at a frequency displaced with respect to the frequency of the accelerating field. The operation of the device is analyzed and the parameters optimized. (auth)

17664 MAGNETOINDUCTIVE MEASURING INSTRUMENTS. II. Moskalev, V. A.; Shestakov, V. G. pp 27-42 of Kontrol' i Izmerenie Parametrov Puchkov Zaryazhennykh Chastits. Moscow; Atomizdat (1973). (In Russian).

Published material on methods of calculating and designing monitoring and measurement systems for charged particle beams using magnetoinductive measuring instruments are reviewed and classified. The use of such instruments for determining the location of a beam and the currents in nanosecond times is described. Problems of selecting the type of such an instrument for measuring the circulating current in a betatron are considered. A classification scheme for switching on operating regimes with these instruments is described. (INIS)

17665 FARADAY CUP AND A SECONDARY EMISSION MONITOR. III. Moskalev, V. A.; Shestakov, V. G. pp 43-53 of Kontrol' i Izmerenie Parametrov Puchkov Zaryazhennykh Chastits. Moscow; Atomizdat (1973). (In Russian).

Methods are presented for calculating and designing Faraday cylinders and secondary emission monitors used for measuring the charge and the charged-particle-beam current. Special features of the calibration and efficiency testing of a Faraday cylinder and the use of secondary-emission monitors for control and measurement of dimensions, profile and beam location are described. (INIS)

17666 NÉM—1T MAGNETIC—DISCHARGE PUMPS IN THE VACUUM SYSTEM OF THE 1—100 LINEAR ACCELERATOR. Krokhina, O.N.; Mirzoev, K.G. Sov. Phys.—Tech. Phys. 19: No. 5, 698-699 (Nov 1974).

The characteristics of NÉM—1T titanium pumps after prolonged use in the cavities of a linear accelerator are described. The effective sputtering ratio of the titanium in the cell of the electric—discharge pump is determined from measurements of craters on the cathode plates. Experience gained in the use of these pumps in the linear accelerator is used to determine the failure time, the time over which the vacuum system operates stably at a pressure of $(0.5-1) \cdot 10^{-6}$ torr, and the useful lifetime of the pumps under these conditions. (auth)

17667 POWER SEMICONDUCTOR CIRCUIT FOR THE COMMUTATION OF THE SYNCHROTRON ELECTROMAGNET CURRENT. Ivashin, V. V.; Minenko, L. I.; Faskhutdinov, Z. Sh.; Chuchalin, I. P. pp 22-24 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This study considers a number of changes in the feed circuit of the "Sirius" synchrotron electromagnet with semiconductor operation. By transferring the pulse feed system of the synchrotron electromagnet from a thyratron variant of current commutation to a diode-tyristor variant it was possible to simplify the feed system and to improve the operating characteristics of the system. Thyristors TL-150 were used as control commutating units, and VL-200 tubes were used as return diodes. The scheme which was developed showed stable operation at voltages up to 10 kV on the capacitance energy accumulator. (tr-SJR)

17668 MEASUREMENT OF THE ACCELERATED CURRENT IN A SYNCHROTRON BY MEANS OF MEASURING THE SYNCHROTRON RADIATION. Kobeleva, T. A.; Kozhevnikov, A. V.; Makienko, A. V.; Nikitin, M. M. pp 64-66 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes a method of measuring accelerator current based on measuring the intensity of synchrotron radiation from the "Sirius" accelerator. The intensity of synchrotron radiation was measured by a photoelectron multiplier which is calibrated by reference tungsten lamp SI8-200. The optical experimental arrangement is presented. An analysis of possible errors showed that the total measurement error of the accelerator current did not exceed 4%. (tr-SJR)

17669 EXPRESS-MEASUREMENTS OF THE ELECTRON BEAM GEOMETRIC SIZES IN CYCLIC ACCELERATORS. Kozhevnikov, A. V. pp 83-86 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes the results, technique, and equipment for measuring the geometric dimensions of an electron beam using the synchrotron radiation. It was possible to obtain information in the form of electric signals. A block diagram of the measuring unit is presented. (tr-SJR)

17670 CHOICE OF THE OPTIMIZING DEVICE BY MEANS OF DIGITAL AND ANALOG COMPUTER SIMULATION FOR THE PMB-6 BETATRON. Zakharov, V. V.; Novikov, A. A.; Rogachevskaya, M. M.; Son, M. G. pp 75-80 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper considers the problem of controlling a betatron by means of a small optimizer which would assure continuous maintenance of maximum radiation intensity as a function of the control variables (filament current and injection phase). The problem of optimizer selection is solved by analogue and digital computer simulation. The results of the study showed that a coordinate optimizer is recommended for the PMB-6 betatron. (tr-SJR)

17671 PULSE MODULATOR FOR A MICROTRON. Butakov, L. D.; Dubich, V. K.; Kiryukhina, G. F.; Tatarnikov, G. P. pp 90-91 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes the principles of operation and construction features, and presents a diagram of a modulator for a 10 MW magnetron generator. The modulator generates pulses having a maximum amplitude of 55 kV, a duration of 3 to 10 microseconds and a following frequency of 4 cycles per second. The nonuniformity of the pulse peak at the modulator exit is not more than 1%. (tr-SJR)

17672 STUDY ON THE EFFICIENCY OF USING A CONTRACTOR IN THE PMB-6 BETATRON. Chakhlov, V. L.; Romanov, V. V.; Nesterov, A. S. pp 9-12 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This report describes the technique, and presents the results of an experimental study in the efficiency of using an orbit contractor in the PMB-6 betatron. Results are shown on the dependence of the relative increase in yield of bremstrahlung radiation and the dependence of the current in the windings of the contractor as a function of the position of the windings according to radius, and in addition, the dependence of the yield of bremstrahlung radiation is given as a function of the magnitude in the delay of the injection pulse. On the basis of the experiments which were carried out, technical requirements are formulated for the parameters of the contracting device in the PMB-6 betatron. A betatron control scheme with a contracting device, which meets these requirements, is shown. (tr-SJR)

17673 NORMALIZER OF THE PROBE SIGNALS OF THE SIRIUS SYNCHROTRON AUTOMATIC CONTROL SYSTEM. Anokhin, V. P.; Gostev, B. M.; Kochegurov, V. A.; Khlopovskikh, V. M. pp 72-75 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes the features and functional arrangement of a receiver signal normalizer of the automatic control system of the "Sirius" synchrotron. The equipment for normalizing receiver signals is intended for measuring all receiver signals, reducing them to the scale of the working voltages of the channel commutator and the analogue-digital converter, and for matching the time parameters of the receiver signals with the moment of measurement and with the fast action of the analogue-digital converter. A feature of the normalizer scheme is the presence of a pulse expander. A block diagram of one stage of the signal pulse expander is presented. (tr-SJR)

17674 EXTRACTION OF SYNCHROTON RADIATION FROM A CYCLIC ELECTRON ACCELERATOR WITH A STRONG MAGNETIC FIELD. Kvochka, V.I.; Panasyuk, V.S.; Romanovskii, V.F.; Samoilov, L.N.; Sokolov, A.A.; Stepanov, B.M.; Tereshkin, Yu.M. Sov. Phys.—Tech. Phys. 19: No. 6, 762-766 (Dec 1974).

An effective system for extracting synchrotron radiation from a cyclic electron accelerator with a strong magnetic field is described. This system uses a reflector in the accelerating chamber. The gains for a single reflecting surface of revolution and that for a system of two such surfaces are determined. The quality of the image of the electron orbit obtained through the use of a single reflecting surface of revolution is evaluated. Extraction of synchrotron radiation by means of a reflector outside the accelerator chamber and the use of composite reflectors are also examined. (auth)

17675 RESONATOR WITH AZIMUTHALLY VARYING END PLATES. Vorogushin, M.F.; Petrunin, V.I. (D. V. Efremov Scientific—Research Institute of Electrophysical Apparatus, Leningrad). Sov. Phys.—Tech. Phys. 19: No. 6, 767-769 (Dec 1974).

In the design of cyclotrons with an azimuthally varying electric field there is a need for analytic expressions for the field components in a resonator with azimuthally varying end plates. This problem cannot be solved exactly by the usual methods as the variables do not separate in any orthogonal coordinate system. In the present paper convenient expressions for the field components are found by constructing a solution in the form of the product of a certain scalar function of the radius and the vector static field of an azimuthally varying gap. It is shown that this representation is valid if the number of variations around the azimuth is sufficiently large and the amount of variation is bounded. (auth)

17676 MEASUREMENT OF THE CHARGE ACCELERATED IN THE BETATRON. Moskalev, V. A.; Gromov, Yu. A. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 5, 138-139(1974). (In Russian).

The use of electrostatic signal electrodes for the measurement of the charge accelerated in the betatron has been suggested. The use of conducting coating in the camera as the electrostatic signal electrode in betatron measurements was suggested and the characteristics of such an electrode were determined. The electrodes, constructed to fulfill these characteristics, were tested on the high current 15-MeV betatron and gave a precision of 20%. (tr-auth)

Ion Sources and Injection and Extraction Systems

17677 (ANL/HEP-7440, pp III.1-III.19) POLARIZED ION SOURCES. Glavish, H. F. (Stanford Univ., CA). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

The theory behind polarized ion sources is given first, and then the paper is specialized to the atomic beam type of source. The principal depolarization effects are listed. The atomic beam system (including supersonic flow), the separating magnet, and ionization are discussed. In conclusion, spin precession and means to change the direction of the spin axis at the target are considered. (6 figures, 2 tables) (RWR)

17678 (BARC-768, pp 161-165) PRESSURE–YIELD CHARACTERISTIC OF r.f. ION SOURCES. Misra, S. N.; Gupta, S. K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

17679 (CONF-740522-, pp 309-313) POLARIZED ELECTRON SOURCE FOR THE STANFORD LINEAR ACCELERATOR. Alguard, M. J. (Yale Univ., New Haven); Ehrlich, R. D.; Hughes, V. W.; Ladish, J.; Lubell, M. S.; Lysenko, W.; Schueler, K. P.; Baum, G.; Raith, W. 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

A polarized electron source suitable for injection into the 20-GeV Stanford Linear Accelerator has been developed and is currently being installed at SLAC. Based on a prototype built a number of years ago, the polarized electron source (PEGGY) relies on the photoionization of an intense spin polarized beam of ^{6}Li atoms by pulsed uv light. When final installation is completed, PEGGY should deliver 10^9 electrons/pulse in a 1.5 μsec pulse with a polarization of 0.9 at a repetition rate of 180 pulses/sec. (auth)

17680 (CONF-740522-, pp 451-455) SLOW RESONANCE EXTRACTION OF TWO SIMULTANEOUS BEAMS WITHOUT RF STRUCTURE. Cho, Y.; Crosbie, E. A.; Lewis, L. G.; Potts, C. W.; Ratner, L. G. (Argonne National Lab., IL). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The installation of a digital phase angle control system for the Zero Gradient Synchrotron (ZGS) magnet power supply firing circuits reduced the low frequency ripple to the point where a magnetic beam spill mode with rf off has become feasible. Orbit warping magnets using feedback from the extracted beam are used to compensate for remaining ripple, and main magnet flattop control is used to move the beam to the $\nu_r = 2/3$ extraction point. To date, a combined extraction efficiency for the two beams of 50% has been achieved. There is 0% rf structure and about 20% of low frequency modulation. (auth)

17681 (CONF-740522-, pp 467-470) SIMULATION OF SIMULTANEOUS BEAM SHARING BETWEEN INTERNAL TARGETS

AND SLOW EJECTION AT THE CPS. Bell, M.; Kubischta, W. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The slow ejection of the CPS, going either to the West or East Hall, shares the beam regularly with one of the two internal targets feeding the South Hall. A simulation program has been written, in order to understand the process of sharing, especially the losses (about 5 to 7% for typically 30 to 50% on the internal target; the efficiency of the ejection itself is 95 to 97%) and the emittance blow-up (about a factor 2 for the vertical emittance) associated with it. In this program, a number of particles are followed through the resonant extraction process, while the target is treated using a Monte Carlo method. Calculated values for efficiencies and emittance blow-up are given and compared with measured values. (auth)

17682 (CONF-740522-, pp 475-479) INJECTION AND TRAPPING OF THE BEAM AT 800 MeV IN THE CPS. Boussard, D.; Boutheon, M.; Carpenter, B.; Lefevre, P.; Potier, J. P. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The principles of injection and trapping of the 800 MeV beam from the CERN PS Booster are briefly described. A local deformation produced by a set of four bumpers displaces the closed orbit on the edge of a septum magnet, while the incident beam is made to jump the septum thickness by a full aperture kicker. The PS buckets are matched to the incoming bunches; the normal accelerating conditions are then reached adiabatically. A short review of the equipment needed for inflection, longitudinal trapping, acceleration and beam measurements is made. Results obtained in running-in sessions and operation are summarized. (auth)

17683 (JINR-P9-8354) SOME PROBLEMS OF THE ELECTRON BEAM INJECTION IN THE COMPRESSOR OF THE ION COLLECTIVE ACCELERATOR MODEL. Zhabitskii, V. M.; Ivanov, I. N.; Kosukhin, V. V.; Mironov, V. I.; Rashevskii, V. P.; Sarantsev, V. P.; Sergeev, A. P.; Tyutyunnikov, S. I.; Fartushnyi, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Injection of beams of different lifetimes was investigated. The conditions of small anomalous capture were found for a short beam (18 ns). Under these conditions, the efficiency of the injection system operation was tested. (auth)

17684 (KIYAE-73-15) IDEAL BUNCHING. Kasumov, M. M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1974. 16p. (In Russian). INIS.

With a simple kinematic consideration, ideal relations were actually obtained that are useful in designing injectors with grouping. Similar relations in the literature are simplified compared to the ones derived in this study. It is natural that the values characterizing ideal grouping are determined only by the energy dispersion and emittance. By realizing an ideal grouping device it is possible to obtain the most compact packets with the most complete usage of the beam. (tr-SJR)

17685 MEASUREMENT OF THE SYNCHROPHASOTRON SLOW-EXTRACTION EFFICIENCY. Gvozdev, V. Ya.; Issinsky, I. B.; Kryachko, A. P.; Zaitsev, L. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Particle Accel.; 6: No. 1, 53-55(1974).

When the extraction efficiency is about 100 per cent, difficulties arise in its measurement with sufficient accuracy. A measurement of the extracted and circulating (accelerated) beam intensities, the ratio of which determines the efficiency, is done with an accuracy not better than 5 to 10 per cent. A method for determining the efficiency with high accuracy is described. It is based on the fact that a total flux of secondary particles radiated by the accelerator into the surroundings is proportional to the number of accelerated particles lost inside the vacuum chamber. This was confirmed at the synchrophasotron by measuring the number of pulses produced by the flux of secondary particles in scintillation counters placed around the accelerator. Measurements were performed for different conditions of the beam spill on the internal target and vacuum chamber walls at a constant intensity of the accelerator beam. In all cases the total counting rate was constant within ±5 per cent. Thus, when the extraction system operates, the secondary radiation detectors record a value corresponding to the beam part not ejected out of the accelerator. When the extraction system is turned off they detect a value corresponding to the total intensity of the accelerator beam. The secondary particle flux measurement with extraction and without it makes it possible to find the extraction efficiency. The measurement of the slow extraction efficiency at the Dubna synchrophasotron has been done by this method and is equal to 94 ± 0.5 per cent. (auth)

17686 MULTITURN INJECTION INTO THE 76-GeV PROTON SYNCHROTRON. Ado, Yu. M.; Zaitsev, V. I.; Ovchinnikov, M. F. At. Energ. (USSR); 37: No. 5, 396-399(Nov 1974). (In Russian).

This paper describes results of work performed at the IHEP proton synchrotron on increasing injection duration. A brief description of the method used to fill the accelerator radial phase space with particles during two or three revolutions of the beam is presented. Changing the voltage in steps on four deflection capacitors used to inject the beam into the accelerator makes it possible to achieve efficient capture of particles in the working frequency range of betatron oscillations. Measurements have shown that in spite of decreasing coefficient of particle capture with increasing injection duration the total number of particles captured during the accelerating cycle increases and reaches 4×10^{12} ppp in the case of three-turn injection, providing an intensity of 2.5×10^{12} ppp accelerated to maximum energy. (auth)

17687 CIRCUIT FOR THE AUTOMATIC SYNCHRONIZATION OF PULSE GENERATORS WITH AN ACCURACY IN THE NANOSECOND RANGE. Vizir, V. A. pp 28-37 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

Features are described for an automatic system of stabilizing the delay in triggering a thyratron. This scheme was developed for synchronization of the generator of a deflector system for beam extraction, where the commutator is a thyratron TGI I/3000/50 having a peaking circuit at the shock front. A block diagram is presented along with a time diagram of the operation of the most important unit of the commutator circuit. The system was built on a test generator. The stability of synchronization over a period of 8 hours during a change in the mode of operation did not exceed ±3 nsec. (tr-SJR)

17688 INCREASE IN THE SYNCHROTRON INJECTION EFFICIENCY. Vizir, V. A.; Fomenko, G. P. pp 24-28 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes an approximation method of calculating the capture coefficient in the mode of accelerating an electron beam filling the working region and having a homogeneous distribution with respect to amplitudes of betatron oscillations and with respect to energies in the interval of E ± dE. A short description is presented on a scheme of creating a spiral field which serves to retain electrons within the limits of the working region during the period of establishing the amplitude of the accelerating field voltage. The dependence of the capture coefficient is shown as a function of the time of establishing the accelerating field strength in the presence and absence of the eddy field. The theoretical and experimental data showed that the use of a vortex electric field to increase the capture coefficient in a synchrotron is effective, especially for long periods of time in establishing the field tension on the resonator. (tr-SJR)

17689 CHOICE OF THE PARAMETERS OF THE INJECTION SYSTEM WITH A HIGHER EXCITATION FREQUENCY FOR A SMALL BETATRON. Bel'tyaev, Yu. N.; Pushin, V. S. pp 15-17 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

Results are presented on calculating the average power on the injector anode of the acceleration chamber of a portable BUK-6 betatron and the anode surface temperatures in the frequency range from 50 to 1000 cycles per sec. (tr-SJR)

17690 SEMICONDUCTOR VOLTAGE GENERATORS FOR THE INJECTION SYSTEM. Bel'tyaev, Yu. N.; Istomin, B. F.; Kas'yanov, V. A.; Kagadaj, G. N.; Shtejn, M. M. pp 12-15 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper deals with the problem of investigating the possibility of using semiconductor commutator-thyristors and transistors in generators of injection voltage. Results are given of an experimental study of the effect of parameters of the rectangular and bell-shaped injection pulses on the radiation intensity from small portable betatrons. Primary technical data are presented for an injection generator of the PMB-6 betatron. It is noted that the semiconductor voltage generators are small in size and weight, and are fed from windings found on the betatron electromagnet, so that it is possible to combine the generator in one unit with the electromagnet, and thus, to eliminate the necessity of using high-voltage lines. (tr-SJR)

17691 RESEARCH AND DEVELOPMENT OF THE ELECTRON BEAM EXTRACTION FROM THE SMALL TRANSPORTABLE BETATRON PMB-6. Erofeeva, G. V.; Milyutin, G. V.; Pushin, V. S.; Ryzhkov, B. A.; Chakhlov, V. L. pp 17-20 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes the technique, and presents the results of investigating electron beam extraction from the PMB-6 betatron by the methods of unsymmetrical displacement and parametric resonance. In order to compare these methods according to the strength of the excitation field required to displace the electrons, according to the magnitude of the region of release and according to the effect of the static inhomogeneity, a solution was sought on the MPT-9-3 analogue computer for the equation of motion of the electrons with introduction of the excitation field. From the simulation results the smallest beam size was determined at the smallest displacement energy. The static azimuthal inhomogeneity had no effect on the displacement process. Results of experiments on extraction of the electron beam are presented. (tr-SJR)

Ion Optics and Field Calculations

17692 (ANL/HEP-7440, pp II.1-II.9) ACCELERATION OF POLARIZED PROTONS IN SYNCHROTRONS. Khoe, T. K. (Argonne National Lab., IL). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

The particles injected into a synchrotron at the desired location and in the correct direction will travel along a closed curve z. In practice, most of the particles are launched with a slight error in the initial conditions, and will oscillate back and forth about the equilibrium orbit (curve z). The particles having vertical motions will experience alternating horizontal fields. If the particles are polarized protons, these alternating fields could affect the spin orientation. This paper discusses the beam dynamics of polarized protons in weak-focusing accelerators like the ZGS. (7 figures) (RWR)

17693 (CONF-740522-, pp 218-222) ACCELERATION OF ELECTRON RINGS AND INVESTIGATIONS ON ION-ELECTRON INSTABILITIES IN THE GARCHING ERA-EXPERIMENT. Andelfinger, C.; Dommaschk, W.; Hofmann, I.; Merkel, P.; Schumacher, U.; Ulrich, M. (Max Planck-Inst. fuer Plasmaphysik, Garching, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

In the Garching ERA device ("Schuko") with fast ring compression, electron rings have recently been accelerated in a slightly nonuniform field. Near the end of electron ring compression and during the roll-out phase, collective radial oscillations were observed. They showed an obvious dependence on the amount of ion loading and on azimuthal distortions of the electromagnetic field. For the compression phase, these oscillations were suppressed successfully by changing the magnetic field index and increasing the Landau damping coefficient. There occur still losses near the spill-out point. Further investigations will be carried out to suppress these losses, possibly by applying an additional B_φ-field. (auth)

17694 (CONF-740522-, pp 223-225) ENERGY SPREADING AND ENERGY LOSS DUE TO NEGATIVE MASS INSTABILITY IN AN ELECTRON RING EXPERIMENT. Fink, J.; Herrmann, W.; Ott, W.; Peterson, J. M. (Max Planck-Inst. fuer Plasmaphysik, Garching, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The aim of the experiment described here was to find limitations for the conductivity of the walls surrounding the ring. To suppress the negative mass instability or transverse resistive wall instabilities, highly conducting walls are necessary. On the other hand, the rising magnetic field in fast compression requires a low enough conductivity for almost undisturbed penetration of the field. For the relatively slow compression of the Berkeley experiment a surface resistance of 1/30 Ω/□ has been sufficient. For compressors like the Garching fast ERA-device (Schuko) with compression nearly 100 times faster, surface resistances of at least 1 Ω/□ will be required. It seemed worthwhile finding out in a separate experiment whether such sidewalls are compatible with the above mentioned requirements for stability. The experiment was performed in the so-called "Unkompressor," a system with a static main magnetic field where ring formation is possible without compression. (WHK)

17695 (CONF-740522-, pp 230-234) EXPERIMENTAL AND THEORETICAL STUDIES OF ELECTRON RING FORMATION AND ION LOADING IN THE MARYLAND ERA. Destler, W. W.; Greenwald, A.; Hudgings, D. W.; Kim, H.; Misra, P. K.; Reiser, M. P.; Rhee, M. J.; Zorn, G. T. (Univ. of Maryland, College Park). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

In the University of Maryland ERA experiment, a rotating electron ring beam is formed by passage of a hollow cylindrical beam through a cusped magnetic field geometry. The initial research objectives, present status of the project, and recent results of experimental and theoretical studies are described. Electron beams with peak currents up to 3 kA and peak voltages of 2 MV have been passed through the cusp. Pulse width, coherent and incoherent radial motion, is in relative good agreement with single-particle theory. Transmission efficiency and radial width of the beam are strongly dependent on peak current, magnetic field and kinetic energy. Electrons with energies appreciably higher than those corresponding to the injector voltage were observed downstream from the cusp. This "auto-acceleration" effect is an indication that beam compression occurs which produces strong space-charge fields as is desired for collective ion acceleration. A neutral gas pulse is injected from a puff valve. Positive ions created by electron collision have a significant focusing effect on the electron beam. (auth)

17696 (CONF-740522-, pp 245-249) SELF-CONSISTENT EQUILIBRIA OF ACCELERATED RELATIVISTIC ELECTRON RINGS. Hofmann, I. (Max Planck-Inst. fuer Plasmaphysik, Garching, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

A self-consistent model and numerical code for a relativistic electron ring loaded with ions was developed, using realistic distribution functions for adiabatically changing equilibria. The main result is that in an ion-focused ring the "holding power" $e\epsilon_R$ is only about 20% of the ring peak electric field, whereas an additional electric image cylinder ("squirrel cage") allows ion acceleration up to 80% of the peak electric field. (auth)

17697 (CONF-740522-, pp 327-328) COLLECTIVE EFFECTS ON ORBIT DYNAMICS. Mills, F. E. (Fermi National Accelerator Lab., Batavia, IL). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

An introductory paper to other papers presented at this conference on the collective effects on orbit dynamics is presented. (WHK)

17698 (CONF-740522-, pp 341-346) HEAD-TAIL TYPE INSTABILITIES IN THE CERN PS AND BOOSTER. Gareyte, J.; Sacherer, F. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

A single-bunch instability of the head-tail type has been observed for several years in the PS. Only mode zero is seen even though the phase shift between head and tail is changed from zero to over 100 radians by varying the machine chromaticity. According to theory, the bunch spectrum is centered on the "chromatic" frequency f_ξ = phase shift/bunch length, and has a width of about 100 MHz (inverse bunch length). Near transition, f_ξ can be varied over a range of 2 GHz, thus providing an excellent probe of the transverse coupling impedance seen by the beam. One finds a broad-band spectrum with a flat maximum near 1 GHz. This is consistent with the absence of higher modes. Thresholds versus octupole strength and beam emittances have been measured and compared with theory. The present cure is octupoles, but reduction of the chromaticity to zero is foreseen for higher intensities (~10^{13} ppp). In the Booster, head-tail modes zero, one, two and three occur, the higher modes occurring for large chromaticities and mode zero for zero or small chromaticities. The growth rate increases rapidly as the Q-value approaches 5 from below. This is a coupled-bunch multi-turn phenomenon that is well explained by the resistive-wall effect. The e-folding times of a few ms require a total wall resistance of about one Ohm at low frequencies, in agreement with the resistance of the thin walled vacuum chamber. (auth)

17699 (CONF-740522-, pp 347-351) TRANSVERSE BUNCHED BEAM INSTABILITIES: THEORY. Sacherer, F. J. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

A unified approach for a parabolic bunch that includes both single-turn and multi-turn effects is presented. The main ingredients are oscillation modes, transverse coupling impedance, and stability criterion. The derivations are given in other papers (F. J. Sacherer, Methods for Computing Bunched-Beam Instabilities, CERN/SI BR/72-5 and F. J. Sacherer, Dispersion Relations for Head-Tail Modes, CERN/BR/74-4) and only the results are presented. (WHK)

17700 (CONF-740522-, pp 380-384) LANDAU DAMPING BY NON-LINEAR SPACE-CHARGE FORCES AND OCTUPOLES. Moehl, D.; Schoenauer, H. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Increasing the PSB and CPS intensities to 10^{13} ppp will require more powerful octupoles in order to overcome the transverse instabilities that are to be expected. Unfortunately, theory fails to give quantitative predictions at low energies, where direct space-charge forces dominate over image forces. To be able to specify the future needs more precisely, an extension of the theory would be desirable, particularly since experimental evidence is such that it is hard to extrapolate to higher intensities. The theory presented here solves the dispersion relation, including the influence of external and space-charge induced non-linearities in both transverse dimensions as well as a spread in the LNS coefficient U. Results are preliminary in the sense that modulation of the space-charge forces due to synchrotron motion is not included. They show that the combined effect of external and space-charge non-linearities in the two transverse planes can considerably enhance Landau damping in low-energy machines (up to 10 GeV, say). The sign of the octupole current is important especially for a flat beam, and should be chosen in such a way that ν increases with amplitude in the direction where the beam is wide. Stability diagrams for several typical conditions are presented and applied to the PSB. (auth)

17701 (CONF-740522-, pp 405-409) INTRA-BEAM-SCATTERING. Piwinski, A. (Deutsches Elektronen-Synchrotron DESY, Hamburg). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The excitation and damping of betatron oscillations and the energy spread due to intra-beam scattering is investigated. It is shown that below transition energy an equilibrium for the particle distribution exists which does not depend on the number of the particles. The rise times and damping times for betatron oscillations and energy spread are calculated. The investigation shows that this effect sets a limit to the intensity of stored proton beams at energies below a few GeV. (auth)

17702 (CONF-740522-, pp 429-433) STOCHASTIC EFFECTS IN LONGITUDINAL PHASE SPACE. Gumowski, I. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Some estimates of the stochasticity domain of a particular Hamiltonian dynamic system with a continuously increasing non-linearity have been given elsewhere. These estimates are not directly applicable to longitudinal motion in a circular accelerator because in the latter case the non-linearity is periodic and bounded. An extension of the method shows that in accelerators such as the CERN PS and PSB the accelerating voltage non-linearity produces stochastic behavior only in the close vicinity of the separatrix. The usual description of a microtron is shown to imply the existence of a large stochastic domain. (auth)

17703 (CONF-740522-, pp 434-438) GAMMA-TRANSITION-JUMP SCHEME OF THE CPS. Hardt, W. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

In 1973, the former Q-jump system has been replaced by 8 fast and 6 slowly pulsed quadrupoles forming 4 doublets and 2 triplets respectively. They allow presently a change of γ_t by ≃ 2.3 (instead of ≃ 0.23), limited only by the power supply within 0.8 ms (<0.4 ms with a new supply under construction). Transition is crossed 50 times (instead of 5 times) faster than without jump. More than 5×10^{12} p/p have been accelerated operationally and brought through transition within a bunch area of ≃ 10 mrad. In the future, it should be possible to handle 10^{13} p/p within the same bunch area. The scaling laws for achievable longitudinal density Ψ (apart from logarithmic terms $\Psi \propto N^{1/4} |\Delta\gamma_t|^{1/4}$ for bunch matching and $\Psi \propto N^{1/3} |\dot{\gamma}_t|^{2/3} |\Delta\gamma_t|^{-1/6}$ for negative mass instability) are in good agreement with experiments. (auth)

17704 (CONF-740522-, pp 439-443) DIPOLE TWO-BEAM INSTABILITY IN CIRCULAR BEAMS WITH AZIMUTHAL NON-UNIFORMITY. Zenkevich, P. R.; Koshkarev, D. G. (Inst. for Theoretical and Experimental Physics, Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The modulation of the beam transversal dimensions in strong focusing accelerators causes the spread of the oscillation frequency of the electrons or ions which are created by ionization of residual gas. The influence of such frequency spread on the stability of the two-beam dipole transversal oscillations is discussed. (auth)

17705 (CONF-740522-, pp 444-446) INTERACTION OF A LONG INTENSIVE ELECTRON BUNCH WITH A PASSIVE CAVITY. Voskresenskii, G. V.; Kurdyumov, V. N. (Radiotechnical Inst., Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The change of energy distribution in an initially monochromatic long electron bunch due to the radiation field induced by the bunch in a passive cavity is investigated. The characteristics of "auto-acceleration" for a long bunch is obtained, the "head-tail" effect dependence on energy for a short intensive bunch is evaluated, and electron ring defocusing averaged over the trajectory is calculated. (auth)

17706 (NIIEFA-D-0179) PROGRAM RIP-1 FOR CALCULATING INTENSE CHARGED PARTICLE BEAMS IN BESM-4 COMPUTER. Kuznetsov, V. S.; Kuznetsova, N. P.; Fidel'skaya, R. P.; Fomichev, A. N. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1973. 50p. (In Russian). INIS.

A description is given of the algorithm and "RIP-1" program for calculating the parameters of extended, intense beams of charged particles in carrying them through focusing and transport systems of accelerators. Consideration is given to circular beams and axially-symmetric optical systems. The text of the "RIP-1" program in BESM-4 language and necessary instructions for operating with the program are presented. (tr-SJR)

17707 (NIIEFA-D-0184) ACCURACY OF THE DISCRETE-CONTINUOUS METHOD FOR THE CALCULATION OF THE INTENSE CHARGED PARTICLE BEAMS. Trubnikov, G. I. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1973. 25p. (In Russian). INIS.

Basic features are presented of a numerical method intended to solve nonstationary, four-dimensional problems on beams not having rotational symmetry. The problem of errors occurring with the use of this and similar methods is investigated in detail. (tr-SJR)

17708 RANDOM PERTURBATIONS OF THE TRANSVERSE MOTION OF PROTONS IN A LINEAR ACCELERATOR AND THEIR CORRECTION. Murin, B. P.; Bondarev, B. I.; Durkin, A. P.; Soloviev, L. Yu. (Radiotechnical Inst., Moscow). Particle Accel.; 6: No. 1, 27-40(1974).

The influence of random perturbations of focusing channel parameters on the transverse dimensions of a beam in a linear proton accelerator is calculated by a new method. The authors did not investigate the isolated particle behavior but investigated the four-dimensional phase volume. This allowed estimation of the increase of the beam radius and of the emittance without any essential limitations of the size of the random perturbations. Simulation by means of computers is used in parallel with analytical methods. The possibility of correcting the center of gravity of the transverse position of the beam and its phase volume transformation is briefly discussed. (auth)

17709 EFFECT OF BEAM WIDTH ON THE INCOHERENT ν-SHIFT DUE TO IMAGE FORCES. Month, M. (Brookhaven National Lab., Upton, NY); Gluckstern, R. L. Particle Accel.; 6: No. 1, 19-26(1974).

The effect of the distribution of charge in a beam of particles on the space-charge ν-shift is considered. At high energy, the major contribution to the space-charge ν-shift comes from the image fields created by the presence of metallic and ferromagnetic boundaries. For beams small with respect to chamber and magnet dimensions, a point source treatment of the beam is adequate. However, when the beam width is comparable to or greater than the chamber height, the distribution of charge cannot be neglected. To study this effect, a rectangular geometry is used. A conducting vacuum chamber, a parallel plate ferromagnetic surface and a coasting ribbon beam are assumed. It is found that for a large beam size, a, relative to chamber height, h (or magnet gap, g), the image-tune-shift has a $1/ah$ asymptotic behavior, and not $1/a^2$, which might appear to be reasonable from image source arguments. The nonuniformity of the ν-shift along the beam is also considered in detail. It is interesting that the unexpected appearance of the transverse resistive wall instability in the CERN ISR, the "brickwall" effect, has been attributed to such a condition in the stacked beam. Finally, numerical computations are performed in order to demonstrate the influence on the image-tune-shift of (1) the chamber sidewalls, and (2) the rate of fall-off of the horizontal charge density distribution. It is found that the main effect of bringing the sidewalls near the beam and/or softening the fall-off of the charge density distribution is an increase in the spread of ν-shifts across the horizontal width of the beam. (auth)

17710 NEW FORM FOR THE THIRD-ORDER ASYMPTOTIC ABERRATION COEFFICIENTS OF ELECTROSTATIC LENSES; APPLICATION TO THE TWO-TUBE ELECTROSTATIC LENS. DiChio, D. (Bari Univ., Italy); Natali, S. V.; Kuyatt, C. E. Rev. Sci. Instrum.; 46: No. 1, 71-76(Jan 1975).

The third-order asymptotic aberration coefficients of round electrostatic lenses are reformulated in terms of the coordinates formed by the projections of the asymptotic incident and final rays onto the reference plane of the lens. In this formulation, all aberration coefficients are finite for all lenses, in contrast to the formulation in terms of coordinates projected onto the focal planes of the lenses, where all of the coefficients become infinite in the limit of very weak lenses and for certain strong lenses. Equations for the six third-order aberration coefficients are derived in the form of integrals involving derivatives of the axial potential no higher than the second. Using these equations and previously calculated potentials and first-order trajectories, we have computed the six aberration coefficients for the accelerating and decelerating two-tube electrostatic lens for voltage ratios from 1.1 to 10,000. The results are believed accurate to better than 0.2%. (auth)

17711 ELECTRON MOTION DYNAMICS IN AN ONDULATOR ACCELERATOR. 1. Ziyakaev, R. G. pp 54-57 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper presents a calculation on the magnitude of the accelerating current with the energy distribution of the particles being taken into account on using dispersion-free turning magnets in an ondulatory accelerator. The calculation is carried out with the following assumptions: magnets are ideal; the injector generates a point source of electrons with pulses in the same direction; of all the components of the high-frequency field only the electric component is taken into account. The equations which were obtained describe completely the motion of electrons in an ondulatory accelerator. (tr-SJR)

17712 ELECTRON MOTION DYNAMICS IN AN ONDULATOR ACCELERATOR. 2. Numerical Results of Electron Motion in an Ondulator Accelerator. Ziyakaev, R. G. pp 57-60 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper presents the results of a numerical calculation of electron motion in an ondulatory accelerator. Data are presented on the exit current and energy from the accelerator. The energy spectrum at the accelerator exit is shown, and possibilities of improving the energy spectrum are considered. (tr-SJR)

17713 COMPUTER INVESTIGATION OF INTENSIVE ELECTRON BEAM MOTION IN LONGITUDINAL MAGNETIC FIELDS. Stanevko, G. I.; Trikhanova, N. V.; Shanin, P. M. pp 80-83 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This report considers the problem of focusing an intense electron beam by a longitudinal magnetic field created by a system of solenoids. A study is made of beam behavior on changing beam current, solenoid current, electron energy, and also on changing the angles of beam divergence at the channel inlet. Two variants of the focusing system were investigated. On the basis of an analysis of the results it is concluded that it is possible to form a high-intensity electron beam by a system of solenoids. (tr-SJR)

17714 INVESTIGATION OF THE CYCLIC CURRENT LONGITUDINAL INSTABILITY INCREMENT DEPENDENCE ON THE SYSTEM PARAMETERS IN THE NON-RESONANCE CHAMBER. Vejngradt, V. F.; Grigor'ev, V. P. pp 46-50 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

With an approximation of a self-consistent field a study is made on the dependence of the increment of longitudinal instabilities as a function of the system geometry and harmonic number of an electron ring in a cylindrical resonator as an example. The results of the numerical calculation are presented. (tr-SJR)

17715 EXPERIMENTAL INVESTIGATION OF THE HIGH-CURRENT ELECTRON BEAM ACCELERATION IN A BETATRON. Moskalev, V. A.; Gromov, Yu. A.; Shestakov, V. G.; Tsimbalist, A. V.; Pogorelov, V. I. pp 20-22 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes the technique and presents results of an experimental study of the connection between the process of generating ratio-emissions and electron losses in the process of acceleration on the 15 MeV, high-current betatron. The connection was made manifest by simultaneously determining the radioemission, the intensity of light emission from the residual gas which is proportional to the beam current and the electron losses according to the scattering x radiation. The experimental results showed that coherent oscillation of the beam in the process of acceleration in high-current betatrons can lead to particle losses. The direction of scattering depends on the frequency of the wave generated in the accelerating chamber. (tr-SJR)

17716 ON THE DAMPING OF COHERENT BETATRON OSCILLATIONS OF RELATIVISTIC BEAMS BY THE DISTRIBUTED AUTOREGULATION METHOD. Ogorodnikov, A. S. pp 50-54 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper considers the suppression of dipole betatron oscillations of an azimuthal homogeneous beam in a cyclic accelerator by means of a distributed servorelation. As a regulating mechanism, consideration is given to a wavy envelope surrounding the beam that combines within itself the functions of a spacially distributed receiver, actuator and operating converter. A dispersion equation describing the beam motion is obtained. The condition of stability for the equation is obtained by means of the Nyquist criterion. (tr-SJR)

17717 EFFECT OF THE RETURN MAGNETIC GUIDE ON THE MAGNETIC CHARACTERISTICS OF THE FIELD IN THE BETATRON WORKING SPACE. Filimonov, A. A.; Chakhlov, V. L. pp 5-9 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper presents the results of an experimental study of the dependence of the magnetic field characteristics in the working gap of a betatron, mainly of the change in radius of the equilibrium orbit, as a function of the construction of the return magnetic guide. A study was carried out on bell-shaped magnetic guides and six-support magnetic guide constructions having poles with "deflectors" and "without deflectors". As a result of the study it was established that in electromagnets having a multi-support construction and poles with "deflectors" a process takes place that involves "autocompensation" of the compression of the orbit caused by saturation of the steel in the central part of the poles and of the central inserts. "Autocompensation" in compression of the equilibrium orbit takes place because of the simultaneous action of the cyclic variation in acceleration as a result of the fall in magnetic field, and the shift in phases between the accelerating and control magnetic fluxes. (tr-SJR)

17718 CHARGED PARTICLE ACCELERATION IN STATIONARY AXISYMMETRIC MAGNETIC FIELDS INCREASING ALONG THE AXIS. Didenko, A. N.; Kononov, V. K.; Filipenko, N. M.; Fomenko, G. P. pp 31-37 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes a theoretical study of particle motion in an accelerator and the selection of optimal parameters for electron and proton accelerators at various energies, in particular, for a 1000 GeV proton accelerator with an injection energy of 100 GeV, and also for a 100 MeV proton accelerator with an injection energy of 10 MeV. (tr-SJR)

17719 AZIMUTHAL AND VERTICAL MOTION IN AN ACCELERATOR WITH AZIMUTHALLY VARYING ELECTRIC FIELD. Vorogushin, M.F.; Petrunin, V.I. (D. V. Efremov Scientific—Research Institute of Electrophysical Apparatus, Leningrad). Sov. Phys.—Tech. Phys. 19: No. 6, 770-772 (Dec 1974).

Power—series and Fourier—series expansions of the potential in an azimuthally varying accelerating structure which satisfies general symmetry conditions are used to derive simple relationships for the index of electrical focusing and the per—orbit energy increment. The advantage of using rectangular variations of the gap boundaries to optimize these parameters is indicated. (auth)

Storage Rings

Refer also to abstracts 17625, 18198, and 18201.

17720 (CONF-740522-, pp 32-36) PRESENT STATUS AND FUTURE PLANS FOR THE ISR. Johnsen, K. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The CERN Intersecting Storage Rings (ISR) are in routine operation for about 3000 hours per year on the average. Of this time 75% is for colliding-beam physics or preparations for such runs, the rest for machine development. The starting luminosity for long physics runs, with acceptable background conditions, has been up to 5.4×10^{30} cm^{-2} s^{-1}. The longest run without refilling lasted 58 hours. During one of the last development runs in 1973, with the booster used as an injector for the CPS, a luminosity of 6.6×10^{30} cm^{-2} s^{-1} was achieved. It is hoped to reach still higher luminosities by further improvements in the vacuum, further developments of means to suppress instabilities and the effects of resonances, by improved phase space densities now available from the CPS, and by the insertions of low-β sections. (auth)

17721 (CONF-740522-, pp 37-42) SPEAR: STATUS AND IMPROVEMENT PROGRAM. Allen, M.; Davies-White, W.; Dean, N. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Operating experience with the SLAC electron-positron storage ring over the past year is summarized. The control of several beam instabilities and the colliding beam performance over a wide operating range are described. The successful application of variable momentum dispersion to increase the beam size and luminosity is described. The improvement program to increase the energy to more than 4 GeV per beam is discussed and the results of testing the components of the new rf system are presented. (auth)

17722 (CONF-740522-, pp 43-48) DORIS, PRESENT STATUS AND FUTURE PLANS. Le Duff, J.; Maidment, J.; Dasskowski, E. (Deutsches Elektronen-Synchrotron DESY, Hamburg, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Experience with the double storage ring DORIS during its first 4 months of operation is described. The maximum average current of about 160 mA for positrons and 750 mA for electrons is limited by single beam instabilities due to interaction with higher modes in the rf cavities. The head-tail effect has not been observed so far. At currents of 130 mA and 300 mA, respectively, a luminosity of $2 \cdot 10^{29}$ cm^{-2}sec^{-1} was measured. (auth)

17723 (CONF-740522-, pp 49-52) DESIGN AND STATUS OF DCI. Marin, P. (Paris Univ., Orsay, France). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The main characteristics of DCI are first briefly described. The present status is then presented, as well as the schedule for the completion of Ring 1 and Ring 2. The expected performances are given for Ring 1 operating with e^+e^- beams and for Ring 1 and Ring 2 operating in the e^+e^+ and $e^\pm e^\pm$ mode of functioning. Typical aspects of these are emphasized concerning the use of DCI for high energy physics and synchrotron light research. (auth)

17724 (CONF-740522-, pp 53-56) NON-DESTRUCTIVE DIAGNOSTICS OF COASTING BEAMS WITH SCHOTTKY NOISE. Borer, J.; Bramham, P.; Hereward, H. G.; Huebner, K.; Schnell, W.; Thorndahl, L. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The finite number of protons in a circulating beam gives rise to statistical fluctuations in the beam current and beam's center of gravity. This Schottky noise is used to monitor the distribution of particles in longitudinal momentum as well as to measure the extrema of the Q-values in a stack without any interference with the beam coasting for many hours. It is also instrumental in detecting the growth of betatron amplitudes at particular orbits of a stack, which helps to discern presence and strength of nonlinear resonances. (auth)

17725 (CONF-740522-, pp 57-62) BEAM LOADING IN HIGH-ENERGY STORAGE RINGS. Wilson, P. B. (Stanford Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The analysis of beam loading in the rf systems of high-energy storage rings (for example, the PEP e^-e^+ ring) is complicated by the fact that the time, T_b, between the passage of successive bunches is comparable to the cavity filling time, T_f. In this paper, beam loading expressions are first summarized for the usual case in which $T_b \ll T_f$. The theory of phase oscillations in the heavily-beam-loaded case is considered, and the dependence of the synchrotron frequency and damping constant for the oscillations on beam current and cavity tuning is calculated. Expressions for beam loading are then derived which are valid for any value of the ratio T_b/T_f. It is shown that, for the proposed PEP e^-e^+ ring parameters, the klystron power required is increased by about 3% over that calculated using the standard beam loading expressions. Finally, the analysis is extended to take into account the additional losses associated with the excitation of higher-order cavity modes. A rough numerical estimate is made of the loss enhancement to be expected for the PEP RF system. It is concluded that this loss enhancement might be substantial unless appropriate measures are taken in the design and tuning of the accelerating structure. (auth)

17726 (CONF-740522-, pp 63-65) SEARCH FOR A BEAM—BEAM EFFECT IN THE ISR. Huebner, K. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The lifetime of an aperture limited weak proton beam at 2 GeV/c was measured in the presence and absence of a strong 26 GeV/c beam colliding with it in eight intersection points. The typical intensity was 5 mA in the weak and 12 A in the strong beam. The lifetime of the weak beam, 30 min at 5 mA, was strongly intensity dependent. No effect of the other beam was detectable at this short lifetime. The Q-shift experienced by the weak beam was calculated to be $4 \cdot 10^{-3}$ per intersection. (auth)

17727 (CONF-740522-, pp 66-69) BEAM—BEAM COUPLING IN SPEAR. Helm, R. H.; Lee, M. J.; Matera, M. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The effect of the coupling upon the transverse coherent motion of two separated beams in SPEAR is presented. This effect has been studied for various parameters such as the separation and beta-values where the beams pass, the currents, energy and transverse betatron oscillation frequencies of the beams. (auth)

17728 (CONF-740522-, pp 70-74) VACUUM CONDITIONS FOR PROTON STORAGE RINGS. Calder, R.; Fischer, E.; Groebner, O.; Jones, E. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The stability of coasting beams in storage rings depends critically on the vacuum. The beam is perturbed both by scattering on the residual gas molecules and neutralization effects resulting from gas ionization. Historically, these considerations were the only ones employed in the design of the ISR vacuum system. The operational experience with the ISR has shown that the vacuum itself may be perturbed by desorbed gas resulting from beam induced ion bombardment of the chamber wall. This can lead to an unstable chain reaction and to the destruction of the stored beam. The dynamic vacuum equation including stimulated desorption is applied to the conduction limited case. This shows the importance of the effective pumping speed at every given point and demonstrates the value of good conductance or quasi-distributed pumps. A vital factor is the state of the vacuum chamber wall and its response to low energy ion bombardment. Results of investigations on different materials, cleaning methods and decontamination problems are discussed in the light of their applicability and relevance to the design of large machines. (auth)

17729 (CONF-740522-, pp 75-79) INFLUENCE OF THE SPLIT FIELD MAGNET SPECTROMETER ON THE CERN INTERSECTING STORAGE RINGS. Bryant, P. J.; Perin, R. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The Split Field Magnet (SFM) is a general purpose spectrometer which has been functioning in an intersection of the CERN Intersecting Storage Rings (ISR) since summer 1973. Its equivalent field volume of 28 $T.m^3$ is crossed by the two circulating ISR proton beams. The bending action is compensated by two additional magnets per beam, and the focusing (~2.4 T of integrated field gradient) by adjustable passive beam channels. The residual magnetic field effects were studied for tune changes across the aperture and the excitation of non-linear resonances, especially as the machine superperiodicity is reduced to one. Details are presented of these effects and of their compensation. The luminosity in the SFM is reduced by ~18% due to an increase in the crossing angle of the beams, but the influence of the other factors has been limited to a few percent. Except for tune changes of the order of 0.004, which require minor modifications of working lines at the lower energies, and a small influence on high precision closed orbit bumps used for luminosity measurements, the ISR behave as if the SFM were not present. No operational restrictions have been encountered and all special facilities, such as acceleration to 31 GeV/c by phase displacement, remain unaffected. (auth)

17730 (CONF-740522-, pp 80-82) DYNAMIC COMPENSATION DURING STACKING OF THE DE-TUNING CAUSED BY SPACE CHARGE EFFECTS. Bryant, P. J. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The incoherent tune-shifts, due to space charge, distort the tune values across the machine aperture (working line) and lead to the eventual onset of coherent instabilities. Until recently, for high intensity stacks in the CERN Intersecting Storage Rings (ISR), pre-stressed working lines have been used, which assume an ideal form under a given space charge load. Such lines require a lot of space in the tune diagram making it necessary to tolerate 5th order non-linear resonances inside the stack with a subsequent increase in decay rate and background. By correcting the incoherent tune-shifts during stacking by means of a progressive variation of the currents in the poleface windings, the line never deviates far from its ideal shape. In this way, practically the full tune-spread can be maintained throughout and the line requires less space in the tune diagram. This enables stacks occupying the full width of the vacuum chamber to be kept free of all resonances lower than the 8th order. The corrections are calculated according to the wanted stack position and intensity, so giving a high degree of flexibility. Working line measurements made inside the stack at each step have shown the calculation method to be very accurate. Despite the greater complexity, several variants have been made operational and the highest luminosity, which has been achieved under physical condidtions (6.6×10^{30} $cm^{-2}s^{-1}$), has been obtained using this technique in conjunction with stabilization by transverse feed-back on the stacks. (auth)

17731 (CONF-740522-, pp 83-86) TUNE SHIFT COMPUTATION FOR STORAGE RINGS WITH LOW-BETA SECTIONS. Buon, J. (Paris Univ., Orsay, France). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

On present rings with low-beta sections, the thin lens approximation for computing the betatron tune shift is no longer valid. Here the longitudinal distribution of the transverse electric field, generated by a stored bunch, is computed. The transfer matrix across the interaction region is obtained for small amplitude betatron motion. The linear betatron tune shift is derived for low-beta section. (auth)

17732 (CONF-740522-, pp 87-91) EXPERIMENTAL INVESTIGATION OF SINGLE-BEAM SPACE CHARGE EFFECTS. Bryant, P. J.; Gourber, J. P. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

In order to improve the performance of the CERN Intersecting Storage Rings (ISR), it has become increasingly important to investigate experimentally the transverse space charge effects of both single-beam and beam-beam origin. The image-dominated, single-beam effects cause, in the first order, closed orbit distortions which have been measured and related to the coherent tune-shift variation across the aperture. Corrections for high precision bumps, used for luminosity measurements, have been calculated. This effect is also important when optimizing the beam-beam count rate. In the second order, these forces cause an incoherent tune-shift which is taken into account when adjusting the tunes across the aperture. The excitation of nonlinear resonances by higher order effects has also been observed. The vertical closed orbit distortion due to beam-beam forces is one order of magnitude smaller than the corresponding single-beam effect. Measurements of this distortion have been related to the beam-beam tune-shift. Higher order effects are the strongest source of excitation for vertical non-linear resonances. The horizontal and coupled resonances are excited to a much lesser extent. It has been shown experimentally that by the appropriate adjustment of the beam-beam separations in the intersecting regions, this excitation can be minimized so reducing the decay rate and improving the physics conditions. (auth)

17733 (CONF-740522-, pp 92-96) RF SYSTEMS FOR HIGH-ENERGY e^-e^+ STORAGE RINGS. Allen, M. A.; Wilson, P. B. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Electron or positron beams in a storage ring radiate electromagnetic energy at a rate proportional to the fourth power of the recirculating energy, and this loss must be supplied by an rf system. Furthermore, a substantial overvoltage is required to contain the stored beam against losses due to quantum fluctuations in the emitted photons. As an example, an improvement program, SPEAR II, is now underway to increase the energy of the SPEAR ring to 4.5 GeV. At this energy, the radiation loss per turn is 2.8 MeV, and to maintain a reasonable lifetime against quantum fluctuations, a peak voltage of 7.5 MeV is required. Thus, the SPEAR II rf system is similar to a continuously-operating 7.5-MeV linear accelerator. Furthermore, the available straight-section space in the ring which is suitable for containing the accelerating structures is limited, and this means that a cavity design must be sought with a high shunt impedance per unit length so that the power dissipated in cavity wall losses will be held to a reasonable level. In the case of SPEAR, about 9 meters of straight section space is available for accelerating cavities, requiring a gradient of close to 1 MV per meter. The PEP 15-GeV ring would require peak accelerating voltages of around 50 MV, with about 60 meters of straight-section space available for accelerating structures. (auth)

17734 (CONF-740522-, pp 97-99) BEAM DYNAMICS EXPERIMENTS AT SPEAR. Sabersky, A. P.; Wilson, P. B.; Wiedemann, H. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The single-particle properties of beams in storage rings are well understood, but high density single and colliding beams suffer from a variety of instabilities due to self-forces and interactions with their surroundings. The chief experimental problems in the study of stored beams arise from the difficulty of devising beam-diagnostic probes which do not affect the stored beams or disturb the phenomena being studied, and which give unambiguous results when different phenomena act on the probes simultaneously. In the SPEAR electron-positron storage ring, there are apparatus and methods for measuring center-of-mass motions of beams on all three axes, as well as motions with higher moments. The shapes of the beam bunches can also be accurately measured. The techniques used to study instabilities and measure operating characteristics are described. (WHK)

17735 (CONF-740522-, pp 100-103) BEAM ENLARGEMENT BY MISMATCHING THE ENERGY-DISPERSION FUNCTION. Helm, R. H.; Lee, M. J.; Paterson, J. M. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The natural beam size at the interaction point of a storage ring can be increased by operating the machine in a configuration in which the energy-dispersion function (η-function) is nonrepetitive in the periodic cells of the machine lattice. This mode of operation has been studied in SPEAR and is being considered in the PEP design. The usual method of beam enlargement in SPEAR has been to operate the machine in a configuration with a large value of the η-function at the interaction point, but with periodic η-function in the cells. Some of the results of this study are described. (auth)

17736 (CONF-740522-, pp 113-114) DIRECT MEASUREMENTS ON THE BEAM–BEAM INTERACTION AT SPEAR. Sabersky, A. P. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The electromagnetic field of one colliding beam on another acts as a strong nonlinear lens, causing a spread in wave number (ν). Both the ν spread and its upper limit, $\Delta\nu_0$, have been invoked as causes of the beam-beam current limit in storage rings. The extent of the spread has been searched out at other rings by studying workable operating regions in ν_x, ν_y space. We have studied small changes in the sizes of colliding beams caused by external transverse excitation of one beam over a range of betatron frequencies. The results of the measurements are interpreted as tune shifts and tune spreads. (auth)

17737 (CONF-740522-, pp 193-197) SUPERCONDUCTING STRETCHER RING FOR THE ZERO GRADIENT SYNCHROTRON. Crosbie, E. A.; Khoe, T. K.; Martin, R. L.; Purcell, J. R.; Wang, S. T. (Argonne National Lab., IL). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

A superconducting (beam) stretcher ring (SSR) has been designed for the Argonne National Laboratory 12-GeV Zero Gradient Synchrotron (ZGS). The SSR would be installed in the existing ZGS tunnel outside the present ring accelerator. With fast injection at 12 GeV from the ZGS, a slow resonant extraction from the SSR could supply protons continuously into the two existing external proton beam lines during the time required for the ZGS to cycle and accelerate more protons. Nearly 100% duty cycle could be achieved. Since practically no flattop is required, the ZGS could be run at approximately double the present 4.6 s repetition rate resulting in a corresponding increase in the average beam intensity supplied to the experimental areas. Provisions could also be made to extract the beam into a new third external beam line in the meson building. The layout of the proposed SSR is shown; parameters are listed; and magnet design is discussed. (WHK)

17738 (CONF-740522-, pp 338-340) FAST DAMPING OF TRANSVERSE COHERENT DIPOLE OSCILLATIONS IN SPEAR. Paterson, J. M.; Richter, B.; Sabersky, A. P. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The fast damping phenomenon observed in SPEAR is discussed. Some of the effects of various beam parameters such as chromaticity, rf voltage, octupole lens strength and beam current upon the fast damping are presented. (auth)

17739 (CONF-740522-, pp 352-358) SOME OBSERVATIONS ON BUNCH LENGTHENING AT SPEAR. Allen, M. A.; Fischer, G. E.; Matera, M.; Sabersky, A. P.; Wilson, P. B. (Stanford Linear Accelerator Center, CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The phenomenon of current dependent bunch lengthening discovered at ACO and ADONE about seven years ago can be used as an engineering diagnostic tool to examine how the longitudinal electromagnetic field of a beam couples to its surroundings. The importance of isolating such coupling factors is that they may give rise to damaging instabilities. Another practical reason for studying the effect is that if bunch lengths grow anomalously beyond those calculated on the basis of classical theory, the effective luminosity of storage rings, particularly those employing low beta insertions, may be reduced. As in most other electron storage rings, the effect at SPEAR is observed to be large and may play a role in proton rings if the beam is highly bunched. The functional dependence of the SPEAR bunch length is compared with those of the various theories. The potential distortion model is used to extract a coupling impedance, and the existence of coherent bunch shape oscillations is demonstrated. Frequency shifts with current, and line widths are discussed. The excitation of theoretically predicted vacuum chamber modes is shown after which beam power absorption to those elements of the structure believed to cause bunch lengthening is estimated. In the final section, the prediction that the ferrite kicker magnet cores are presently the dominant elements is confirmed. (WHK)

17740 (CONF-740522-, pp 359-364) INVESTIGATIONS AND CURES OF LONGITUDINAL INSTABILITIES OF BUNCHED BEAMS IN THE ISR. Bramham, P.; Hansen, S.; Hofmann, A.; Huebner, K.; Peschardt, E. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The present status of longitudinal bunched beam instabilities in the ISR is described. Experiments to test the theory have been conducted with a tunable, passive cavity. In order to cope with the instability at higher intensities we expect in the future, possible cures were investigated. A bunch-by-bunch feedback system has been built. It damps dipole and quadrupole oscillations of individual bunches. Stabilization by means of a passive cavity was also successfully demonstrated. (auth)

17741 (CONF-740522-, pp 365-369) CONTROL OF THE BUNCH LENGTHENING PHENOMENON IN ELECTRON STORAGE RINGS. Rowe, E. M.; Trzeciak, W. S. (Univ. of Wisconsin, Stoughton). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

Because of the importance of bunch lengthening in determining the luminosities achievable in electron-positron storage rings, a considerable amount of theoretical work aimed at explaining the phenomenon has been carried out. In 1971, Pellegrini and Sessler gave a general theory of the equilibrium length of high current bunches in electron-positron storage rings. This theory requires inductive coupling between the beam and its surroundings for bunch lengthening to occur above transition energy. Here, the term inductive coupling means that the impedance seen by the beam is inductive, i.e., the structure with which the beam interacts is driven at a frequency below resonance. The theory also allows for the possibility of bunch shortening to occur through the same coupling mechanism, though, to our knowledge, before this present work no such observations have been reported. Subsequently, Sessler extended this work and developed a dynamic theory which describes the turbulent steady state associated with stable non-zero amplitude collective modes. Recently, bunch lengthening has been observed at Tantalus I. A series of measurements made of the bunch length dependence on both current and energy are described which are in good agreement with both the original Pellegrini-Sessler Theory and the more recent development by Sessler. Further, bunch shortening has also been observed and, while the measurements made so far on this manifestation of the phenomenon are not as complete as those made of bunch lengthening, they have been included because of their possible importance. (WHK)

17742 (CONF-740522-, pp 375-379) FAST BEAM-CAVITY INTERACTION AND ITS EFFECT ON BUNCH SHAPE IN STORAGE RINGS. Papiernik, A.; Chatard-Moulin, M.; Jecko, B. (U. E. R. des Sciences, Limoges, France). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

When a bunch of stored particles passes a gap, it induces fields which affect the energy of the particles, and hence the bunch shape. An analytical formula giving the transient voltage is derived for a short bunch of any shape. The equilibrium bunch shape is calculated using Haissinski's self-consistent theory. The bunch lengthens, but comparison with experiment shows that beam-cavity fast interaction is not the main reason for bunch lengthening in rings having only one cavity. (auth)

17743 (CONF-740522-, pp 410-413) DETAILED STUDY OF THE BEAM-BEAM INTERACTION AT THE ORSAY STORAGE RING (ACO). Bergher, M.; Buon, J.; Jejcic, A.; Le Duff, J.; Marin, P.; Sommer, M.; Zyngier, H. (Paris Univ., Orsay, France). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

In the normal operating conditions of ACO the two beam behavior is dominated by the beam-beam interaction. Single beam behavior in the range of energy and current described ($250 \leq E \leq 510$ MeV, $I \leq 35$ mA) exhibits no effect such as resonances, beam losses, etc., in comparison with the ones observed with two beams. In this clear situation a detailed study of the beam-beam interaction has been performed on ACO in 1973. The normal operating conditions are: one bunch per beam, two crossing points and head-on collisions. Radial and vertical wave numbers per turn are set just below an integer, near the coupling resonance $\nu_x - \nu_z = 2$ (usually $\nu_z \sim .835$, $\nu_x \sim 2.845$). Table 1 shows some relevant ring parameters at the crossing points. The main result obtained is the important part played by high order non-linear resonances in the beam loss induced by the beam-beam interaction. This appears in the study of the beam-beam limit as a function of the operating point in the wave number diagram. Other results are reported on: the tune shift parameter ξ at the beam-beam limit; the influence of the number of bunches; the absence of any difference between the interaction of two strong beams versus the strong beam-weak beam interaction; and coherent motion induced by small vertical separations at the crossing points. (auth)

17744 (CONF-740522-, pp 508-510) IMPACT OF COMPUTER CONTROL ON THE PERFORMANCE OF THE CERN INTERSECTING STORAGE RINGS. Wolstenholme, P. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The ISR control system has now developed to a state in which it relies heavily for both routine operation and machine development on the control computer. This gives significant benefits in security of operation, as well as easing the task of controlling a very complex installation. The computer has enabled the machine development team to concentrate on beam studies, without worrying overmuch about calibrations and reliability of individual components, so that they have been able in three years to surpass the original design objectives. (auth)

17745 (CONF-740522-, pp 548-556) DESIGN AND STATUS OF EPIC. Rees, G. H. (Rutherford High Energy Lab., Chilton, Eng.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The present status of the EPIC machine design is outlined. By October 1974 an improved cost estimate will be obtained for a 14 GeV electron-positron storage ring. The physics case for EPIC and a machine proposal will then be submitted to the Science Research council, seeking funds to allow the ring to be built by 1981. (auth)

17746 (CONF-740522-, pp 564-571) PEP ELECTRON-POSITRON RING: PEP STAGE I. Rees, J. R. (Univ. of California, Berkeley). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

The first stage of the positron-electron-proton (PEP) colliding-beam system which has been under joint study by a Lawrence Berkeley Laboratory-Stanford Linear Accelerator Center team for the past two years will be the electron-positron storage ring. The physics justification for the e^+e^- ring is summarized briefly and the proposed facility is described. The ring will have six arcs having gross radii of about 220 m and six interaction regions located at the centers of straight sections about 130 m long. The longitudinal distance left free for experimental apparatus around the interaction regions will be 20 m. The range of operating beam energies will be from 5 GeV to 15 GeV. The design luminosity at 15 GeV will be 10^{32}cm^{-2}s^{-1}, and the luminosity will vary approximately as the square of the beam energy. Alternative methods under consideration for adjusting the beam cross-section are discussed. The designs of the storage ring subsystems and of the conventional facilities including the experimental halls at the interaction regions are described. (auth)

17747 (CONF-740522-, pp 584-587) PRELIMINARY DESIGN OF TRI-RING INTERSECTING STORAGE ACCELERATORS IN NIPPON: TRISTAN. Nishikawa, T. (National Lab. for High Energy Physics, Oho, Ibaraki, Japan). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the 9th international conference on high energy accelerators.

When the present KEK proton synchrotron project was originally proposed, it was expected to bring up the Japanese high-energy physics program to the present frontier of the world high energy physics. However, a shortcut of the budget forced the project to start with a lower energy accelerator and extend it to a higher energy range. Thus the future extension of the presently constructing 12 GeV proton synchrotron is taken into consideration even at the initiation of the present project. Several possible extension schemes such as a large conventional synchrotron in the energy region of 80 to 100 GeV have been considered as a long range plan of the KEK project. At present, however, the future plan of the KEK synchrotron is concentrated on a plan of tri-ring intersecting storage accelerators for various types of colliding beam experiments as $e^\pm p$, pp, e^+e^- and $\bar{p}p$ at very high center of mass energies. This project is nicknamed as TRISTAN (Tri-Ring Intersecting Storage Accelerators in Nippon) and a preliminary design study is undertaken in the KEK Accelerator Department in cooperation with the university scientists and the cryogenic specialists. This is a report on the present status of the preliminary design study of the TRISTAN. (auth)

17748 (CONF-740522-, pp 618-621) ELECTRON PULSE STRETCHER EROS. Heese, N. R.; Servranckx, R. (Univ. of Saskatchewan, Saskatoon). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The Electron Ring of Saskatoon is designed as a pulse stretcher whose purpose is to bring the duty factor of the 250 MeV electron linear accelerator at Saskatoon from a value of 6.25×10^{-4} to a value of 0.8 or more. The ring, into which the 1 μs long linac pulse is injected, is a racetrack shape of 73 m circumference. The electrons are then slowly extracted between linac pulses utilizing a resonance phenomenon. Design optimization, monochromatic extraction, and the main magnet components are described. (WHK)

17749 (CONF-740522-, pp 622-628) PRELIMINARY DESIGN CONSIDERATIONS FOR THE STAGE I PEP LATTICE. Helm, R. H.; Lee, M. J. (Stanford Univ., CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The PEP lattice and its operating characteristics, how the design luminosity and other criteria may be met, and the limits of the operative regions of the beam parameters in several modes are discussed for the proposed PEP e^+e^- storage ring. (WHK)

17750 (CONF-740522-, pp 629-632) DESIGN CONSIDERATIONS FOR A HIGH ENERGY ELECTRON POSITRON STORAGE

RING. Wiedemann, H. (Deutsches Elektronen-Synchrotron DESY, Hamburg). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The influence of the beam optics in the periodic cell structure on the storage ring energy is discussed. It is concluded that to achieve the highest possible energy for a given installed rf-power the focusing in the periodic cell structure should be as strong as possible. For lower energies where the beam-beam effect is effective the total beam current can be pushed up by filling many bunches in one beam, which requires beam separation outside the interaction points. The total linear tune shift due to long range forces is small. Even with beam separation the required apertures seem not to be excessive due to the small beam sizes produced by the strong focusing. (WHK)

17751 (CONF-740522-, pp 633-637) HIGH-INTENSITY STORAGE RINGS FOR MESON FACTORY. Batskikh, G. I.; Vasiliev, A. A.; Kuzmin, A. A.; Meshcherov, R. A.; Murin, B. P.; Rybalko, V. S. (Radiotechnical Inst., Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Design aspects and basic parameters of storage rings are considered. Storage rings are designed to stretch and to bunch the beam of the high-intensity linac-meson factory. Continuous beam as well as intense short (25 nsec) proton pulses are provided. Beam duty factor varies from 10^{-5} approximately up to 1. Peak current of the stored beam reaches 50 A. (auth)

17752 (CONF-740522-, pp 648-649) BASIC DESIGN CONSIDERATIONS ON AN ELECTRON BEAM STRETCHER. Herminghaus, H. (Institut fuer Kernphysik, Mainz, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

In designing an electron beam stretcher for the 300-MeV Electron Linac of Mainz University the main effort was made to get low transversal beam emittance of the extracted beam and to provide some means for flattening the beam intensity. To be compatible with later recycling of the linac the stretcher should be able to operate up to 600 MeV. The magnet ring will mainly consist of two 180° bending systems connected by two long straight sections. A brief description of some less conventional schemes for injection, extraction and spill out control to be used with an electron beam pulse stretcher ring is given. (WHK)

17753 (CONF-740522-, pp 660-670) PERSPECTIVES ON COLLIDING BEAMS. Keil, E. (CERN, Geneva). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The design and performance of colliding beam devices is restricted by two different kinds of limitations, i.e., those due to technology and funds, and those due to space charge phenomena. Among the technological limitations are maximum magnetic fields, rf power, and the stored energy of the beams. The space charge limits are determined by single-beam and beam-beam phenomena, such as the stability of coherent longitudinal and transverse oscillations, or the incoherent beam-beam tune shift. The aim in the design of a colliding beam device is to achieve the best possible luminosity within all these limits. Procedures for determining appropriate machine parameters, which include all constraints from the beginning, have been developed. The resulting parameter sets will be compared to those of machines under study at present. The design procedures also allow predictions on how the parameters and luminosity of future colliding beam devices would change if some or all of the technological limitations were to occur at a different level. (auth)

17754 (CONF-740522-, pp 671-674) SYNCHROTRON RADIATION SOURCES. Kapitza, S. P. (Inst. for Physical Problems, Moscow). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Synchrotrons and storage rings as synchrotron radiation sources in the vacuum ultraviolet and soft x-ray region are discussed. Comparative consideration of several special projects of dedicated SR storage rings is given. (auth)

17755 (CONF-740522-, pp 680-684) 2 GeV 1 A ELECTRON STORAGE RING DEDICATED TO THE PRODUCTION OF SYNCHROTRON RADIATION. Thompson, D. J.; Atkins, V. R.; Hopkins, J. C. (Daresbury Lab., Warrington, Eng.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

An electron storage ring is being designed to replace the 5 GeV electron synchrotron NINA as a source of synchrotron radiation. The new machine will be used solely for this purpose and its design is being optimized to the needs of the experimenters. The characteristic wavelength of the radiation will be 4 Å and the flux at that wavelength about 3×10^{13} photons/s/mr (horizontal) in 0.1% bandwidth. Design considerations include long beam lifetime, small source size and large available solid angle for most beam lines. Assuming a bending field of 1.2 T the beam in the storage ring will have an energy of 2 GeV and the design value of the circulating current will be 1 A. The mean radius will be about 15 m and there will be at least 10 beam lines. Superconducting wavelength shifters or "wigglers" can be incorporated to extend the usable spectrum on two beam lines to 0.1 Å. The new machine will fit into the existing buildings at Daresbury. (auth)

17756 (CONF-740522-, pp 685-688) STANFORD SYNCHROTRON RADIATION PROJECT (SSRP). Winick, H. (Stanford Univ., CA). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

The Stanford Synchrotron Radiation Project is a new national facility for uv and x-ray research using synchrotron radiation from the storage ring SPEAR. This ring now operates in colliding beam mode with E (stored beam energy) varying from 1.5 to 2.5 GeV and with 15 to 45 mA in each beam. Improvements in mid-1974 will raise the energy to $\gtrsim$ 4 GeV with expected currents of up to 100 mA in each beam. The critical energy of the synchrotron radiation spectrum varies as E^3 and is 11 keV for E = 4 GeV. Up to seven experiments can share a beam run which accepts 11.5 mrad of radiation. The uv and soft x-radiation are deflected at grazing incidence on ultra smooth platinum plated copper blocks and focused on custom built, high vacuum, high resolution monochromators. X radiation above about 3.5 keV emerges from a 630 μ thick beryllium window assembly. Sensors in the beam run detect high pressure or contamination and cause valves to close isolating the beam runs from each other and from the SPEAR vacuum system. Shielding and interlocks permit experimenters to adjust their equipment with beam shutters closed and to be within about 1 m of their equipment during operation with shutters open. A broad ranging program of research will be pursued including studies of uv and x-ray photoelectron spectroscopy, extended x-ray absorption edge fine structure, x-ray diffraction on biology systems, compton scattering, x-ray absorption x-ray induced luminescence, sub-nanosecond time constant measurements on solids, and uv reflectivity. (auth)

17757 (CONF-740522-, pp 689-692) CONVERSION OF THE NBS 180 MeV ELECTRON SYNCHROTRON TO A 240 MeV ELECTRON STORAGE RING FOR SYNCHROTRON RADIATION RESEARCH. Rowe, E. M.; Green, M. A.; Trzeciak, W. S.; Winter, W. R. Jr. (Univ. of Wisconsin, Stoughton). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

A diagram of the converted synchrotron is shown and operating parameters are given. The components necessary for the conversion project are described. (WHK)

17758 (LBL-3387) SUPERCONDUCTING SYNCHROTRON-STORAGE RING (ESCAR). Byrns, R.; Elioff, T.; Gilbert, W.; Green, M.; Hartwig, E.; Lambertson, G.; Lou, K.; Meuser, R.; Pope, W.; Staples, J.; Tanabe, J.; Wolgast, D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 13 Nov 1974. Contract W-7405-eng-48. 4p. (CONF-741112-8). Dep. NTIS $4.00.

From fourth all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

The Experimental Superconducting Accelerator Ring (ESCAR) was conceived and authorized primarily as a development project whose main goal would be to develop design and operational experience with a complete accelerator and storage ring system utilizing superconducting magnets. ESCAR will not only provide the experience of fabricating and operating an extensive cryogenic magnet system but it will also provide a comprehensive accelerator system from which can be learned the realities of the interaction between the new cryogenic elements and the many other components of an accelerator. These components (e.g., r.f., injection, vacuum, controls, instrumentation, etc.) are now undergoing design studies and their compatibility with the cryogenic features of the accelerator is scrutinized rigorously. There is no doubt that there will be many deviations from the conventional and normal accelerator technology. Full scale design effort began in July 1974 and operation is planned in 1977. The general design parameters are briefly described. (WHK)

17759 (RL–74-100) PROPOSAL TO BUILD A 14 GeV ELECTRON–POSITRON COLLIDING BEAM FACILITY. (Science Research Council, Chilton (UK). Rutherford Lab.). Sep 1974. 175p.

The subject is covered in chapters entitled: introduction (history and general statement on the project); physics with an e^+e^- colliding beam facility; the machine design; machine components; EPIC parameters; resources and programme; and development potential of EPIC. Further details of the physics potential of EPIC are given: RL-74-124 'A Feasibility Report for a Colliding Beam Facility' which is a report of a feasibility study of electron-positron and electron-proton colliding beam machines. It concentrates on the physics case and physics utilization of such machines and is intended for physicists interested in this field; RL-74-078 "The Scientific Case for EPIC" is a summary of the feasibility report and is intended for those not working directly in this field. (UK)

17760 APPLICATION OF THE PHASE COMPRESSION–PHASE EXPANSION EFFECT FOR ISOCHRONOUS STORAGE RINGS. Joho, W. Particle Accel.; 6: No. 1, 41-52(1974).

In an isochronous cyclotron acceleration is accomplished through several acceleration gaps. A nonuniform voltage distribution along these gaps produces a time-varying magnetic field which affects the longitudinal bunch size. A radially increasing (decreasing) acceleration voltage compresses (expands) the bunch size. This effect can be utilized in an isochronous storage ring with $\lambda/2$ cavities, where particles undergo a cycle of acceleration, coasting at maximum energy, deceleration and coasting at minimum energy. This cycle could be repeated many times if H^- ions are injected into the ring and stripped to protons. Stored beams up to 100 A look feasible. The phase expansion effect can also be utilized to improve the duty cycle of isochronous cyclotrons by a decreasing dee voltage towards the extraction radius or by insertion of decelerating C-electrodes like in the present improvement programs for several synchrocyclotrons. (auth)

17761 PREPARATION FOR STORAGE RING EXPERIMENTS AT DESY. Waloschek, P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg). J. Phys. (Paris), Colloq.; No. 2, 35-44(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

The present state of the construction of the double storage ring DORIS is briefly reviewed, including some data from two experimental devices which are being prepared for 1974. The use and limitation of a tagging system installed along the SR-beams is discussed. (auth)

Experimental Facilities

Refer also to abstracts 17756 and 18207.

17762 (ANL/HEP-7440, pp IV.1-IV.4) ARGONNE POLARIZED TARGET FACILITIES. Hill, D. A. (Argonne National Lab., IL). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

Some of the characteristic features of polarized targets at the present state of the art are sketched. The following are typical for a polarized proton target: a temperature of about 0.5K achieved by a ^{3}He refrigerator, an applied microwave field, an applied static field, and some means for monitoring the polarization (such as an NMR spectrometer). Then some apparatus at ANL used to obtain the above conditions are described; these include magnets, conventional and superconducting; target cryostats; and microwave systems. (RWR)

17763 (CONF-740522-, pp 133-139) MEASUREMENTS ON THE FIRST 20-CELL DEFLECTOR SECTIONS FOR A SUPERCONDUCTING RF SEPARATOR. Bauer, W.; Citron, A.; Dammertz, G.; Grundner, M.; Husson, L.; Lengeler, H.; Rathgeber, E. (Univ., Karlsruhe, Ger.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Experimental results on the first 20-cell Nb deflector sections for an S-band superconducting rf separator are given. A sequence of surface treatments including electropolishing, anodizing and high temperature UHV-annealing has allowed to obtain repeatedly high field Q-values up to 1.8×10^9 and peak magnetic fields up to 400 Oe. This corresponds for the operating mode ($\pi/2$) to deflecting fields of 2.6 MV/m and to electric peak-fields of 14 MV/m. With the same surface treatments we have obtained in a 4 cell test deflector a Q-value of 2.5×10^9 and a peak magnetic field of 850 Oe which corresponds to a peak electric field of 30 MV/m. A new method for localizing cells with high surface resistance in multicell cavities has been applied successfully. It also has been tried to localize the cells where a magnetic breakdown takes place. Perturbation measurements have been performed for a large number of modes and it is shown that the fabrication tolerances ensure a sufficient field-flatness in the $\pi/2$-mode. A movable RF coupling system using a bellow as an outer conductor and a new type of rf joint are shortly described. (auth)

17764 (CONF-740522-, pp 154-158) DEVELOPMENT AND TESTING OF A PROTOTYPE SUPERCONDUCTING RF SEPARATOR. Carne, A.; Bendall, R. G.; Bennett, J. R. J.; Brady, B. G.; Hirst, J. A.; Smith, J. V. (Rutherford Lab., Chilton, Eng.). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

For several years the Rutherford Laboratory has been developing superconducting rf separators, the main purpose of which was to provide separated kaon beams from Nimrod, in the 2 to 4.5 GeV/c momentum range. During 1971 tests were performed on a 2-cell full scale frequency model cavity. The results were sufficiently encouraging to warrant proceeding to a full size operational "prototype" separator to be developed and tested as the first stage of a possible 2-cavity RF separated beamline. The superconductor chosen was lead, electrodeposited onto an OFHC copper substrate. Tests with the prototype have confirmed that lead can sustain the fields required for an operational separator. Some of the aspects of the design and development of the prototype separator, the tests, and results are described. (auth)

17765 (CONF-740522-, pp 198-203) 8° SUPERCONDUCTING BENDING MAGNET IN A PRIMARY PROTON BEAM. Allinger, J.; Danby, G.; De Vito, B.; Foelsche, H.; Hsieh, S.; Jackson, J.; Prodell, A. (Brookhaven National Lab., Upton, NY). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

A large superconducting bending magnet system is in operation in the new beam from the Brookhaven AGS to the 7-ft. Bubble Chamber. Two dipole modules excited to 37 kG with a total magnetic length of 4 m bend 30 GeV primary protons by 8°. The system has operated routinely for several months, traversed in 3 μs by 6×10^{12} protons with a beam power of 30 kJ. The magnet modules have been proven to be very rugged and were found immune to operational beam difficulties which give rise to occasional bursts of radiation heating. The system is designed for on-line operation and computer monitoring of parameters with closed loop He refrigeration. The magnets have demonstrated very little training and have been operated to 44 kG with both modules identical to computed field predictions to an accuracy of $\sim 1 \times 10^{-4}$ over the useful aperture. These are the first superconducting magnets used in a primary proton beam, and are of a type which can be used in future accelerators. (auth)

17766 (COO-3521-58) COMPACT CYCLOTRON NEUTRON DOSIMETRY. Laughlin, J. S.; Canada, T. R.; Simpson, L. D.; McDonald, J. C.; Kuo, T. Y. T.; Mittleman, A. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1973. Contract AT(11-1)-3522. 45p. (CONF-730489-1). Dep. NTIS $5.25.

From German-Austrian Roentgen Congress; Vienna, Austria (12 Apr 1973).

Physical considerations involved in the application of a small cyclotron for neutron therapy are reviewed. The features and limitations of a compact cyclotron of the isochronous type for this purpose are considered. Physical factors include collimation and the measurement of dose rate for different neutron reactions, field sizes, and distances. The distribution of energy deposition events is described in measurements of linear energy transfer for different reactions and different depths as well as their application to relative biological effectiveness. The measured dose distributions available were used to prepare sample treatment plans for specific sites to indicate possible application of neutron beams of these energies. (CH)

17767 CYCLOTRONS IN NUCLEAR MEDICINE. Hoop, B. Jr. (Massachusetts General Hospital, Boston); Laughlin, J. S.; Tilbury, R. S. pp 407-457 of Instrumentation in Nuclear Medicine. Vol 2. Hine, G. J. (Ed.). New York; Academic Press, Inc. (1974).

The operation of medical cyclotron installations is reviewed, and existing cyclotron installations within medical institutions are listed. Facilities for and the principle of cyclotron radionuclide production are reviewed, and the preparation of labeled compounds is discussed. The production and applications of some important short lived radiopharmaceuticals such as fluorine-18, iron-52, iodine-123, and potassium radiopharmaceuticals are described. (Extensive references.) (WHK)

17768 PRODUCTION OF TiT THICK TRITIUM TARGETS ON Cu BACKING. Pivarc, J. (Inst. of Physics, Bratislava). Jad. Energ.; 20: No. 11, 378-379(Nov 1974). (In Czech).

A method for the production of TiT thick tritium targets on Cu backing is described. Ti foil is connected with the Cu backing of the targets by an Ag intermediate layer. The production of backings for these targets and their impregnation with tritium is presented. Neutron yields from several targets are investigated in dependence on the irradiation time. (auth)

17769 ^{15}O AND ^{13}N PRODUCTION BY VAN DE GRAAFF ACCELERATOR. Rydin, R. A.; Engler, R. A. (Univ. of Virginia, Charlottesville. Phys. Med. Biol.; 19: No. 6, 884(Nov 1974).

The report of a preliminary experiment to produce ^{15}O by a Van de Graaf accelerator (Cress, L. W., and Rydin, R. A., 1973, Phys. Med. Biol., 18, 724) quoted a yield which has subsequently been shown to be too high. The gas target cell has now been redesigned, giving yield figures of up to 2.5 mCi for 5.0 μA of a 5 MeV deuteron beam incident on N$_2$ gas at a pressure of 2 atm. Yield figures are also quoted for ^{13}N production. The ultimate yield values at the 25 to 30 μA capacity of the 5.5 MeV Van de Graaff accelerator would therefore be expected to be in the range 10 to 15 mCi of ^{15}O and 5 to 6 mCi of ^{13}N. This would be sufficient for pulmonary function studies using O$_2$, CO, CO$_2$, or N$_2$ gases. (UK)

17770 USE OF THE SYNCHROTRON RADIATION FROM THE SIRIUS ACCELERATOR IN THE VACUUM ULTRAVIOLET REGION. Didenko, A. N.; Kozhevnikov, A. V.; Nikitin, M. M.; Peshkov, A. V.; Timchenko, N. A. pp 60-63 of Proceedings of the Scientific and Research Institute on Nuclear Physics, Electronics and Automatics of the Tomsk Polytechnical Institute. Charged Particle Accelerators. Moscow; Atomizdat (1973). (In Russian).

This paper describes the features of an evacuated optical channel for extraction of synchrotron radiation from the "Sirius" accelerator. The main parameters of the accelerator are given. The results of calculating the spectral, angular and polarization characteristics of the synchrotron radiation are presented for wavelengths from 10 to 1000 Å. (tr-SJR)

17771 POWERFUL SOURCES OF ULTRAVIOLET AND X RAY RADIATION. Yakimenko, M. N. (Lebedev Inst. of Physics, Moscow). Usp. Fiz. Nauk; 114: No. 1, 55-66(Sep 1974). (In Russian).

This review deals with the problems of using cyclic electron accelerators and accumulators as sources of powerful ultraviolet and x-ray radiation. A brief presentation is made of the properties of synchrotron radiation, and also of undulatory radiation which can be generated in these units. Consideration is given to particular cases of using this radiation. A presentation is made of the parameters of native accelerators and accumulators, and beam intensities of synchrotron radiation from these installations in the far ultraviolet and x-ray regions of the spectrum. These characteristics are compared with the corresponding data of the DESY synchrotron in Germany, whose radiation is widely used for x-ray structural analysis of biopolymers, the study of the electron structure of solids and gases, and of surface phenomenon, and many other purposes. (32 references.) (SJR)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

Refer also to abstract 18221.

17772 POSSIBLE MEASUREMENT OF THE PAST COSMIC RAY INTENSITY FROM THE $^{146}Sm/^{147}Sm$ RATIO. Le Roulley, J. C.; Yokoyama, Y.; Lambert, G. (Centre National de la Recherche Scientifique, Gif-sur-Yvette, France). Delft Progr. Rep., Ser. B; 278: No. 19, 869-872(6 May 1974). (In French).

The direct α spectrometry measurement of the relative abundance of samarium 146 and 147 isotopes at the Moon or meteorite surfaces should give an estimation of the mean cosmic-ray intensity through the last 10^8 years. (FR)

17773 INVESTIGATION OF THE ENERGY DISTRIBUTION OF PRIMARY COSMIC-RAY PARTICLES OVER THE ENERGY RANGE FROM 0.01 TO 100 TeV ON THE PROTON-1, -2, AND -3 SPACE STATIONS. Grigorov, N. L.; Nesterov, V. E.; Rapoport, I. D.; Savenko, I. A.; Skuridin, G. A. pp 34-48 of Izuchenie Kosmicheskikh Luchei na Iskusstvennykh Sputnikakh Zemli. Shtern, M. I. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

17774 IZUCHENIE KOSMICHESKIKH LUCHEI NA ISKUSSTVENNYKH SPUTNIKAKH ZEMLI. (Cosmic Ray Studies from Artificial Earth Satellites). Shtern, M. I. (ed.). Moscow; Izdatel'stvo Nauka (1973). 178p.

Satellite-based studies are discussed in the fields of cosmic ray physics and high-energy particle physics, in particular with measurements of the energy spectra of high- and ultra-high cosmic-ray particles and studies of the chemical composition of cosmic rays and high-energy electron fluxes in terrestrial space, carried out on board of satellites of the Proton series. Methodological aspects of these studies are considered. (IAA)

17775 STUDY OF HIGH-ENERGY ELECTRONS IN TERRESTRIAL SPACE ON BOARD PROTON 1 AND PROTON 2 SATELLITES. Grigorov, N. L.; Kalinkin, L. F.; Kogan-Laskina, E. I.; Savenko, I. A. pp 104-111 of Izuchenie Kosmicheskikh Luchei na Iskusstvennykh Sputnikakh Zemli. Shtern, M. I. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

An on-board telescope consisting of two scintillation counters and a Cherenkov counter which was used to measure electron fluxes and to record the energy spectra of 20 MeV to 5 GeV electrons in primary cosmic radiation is discussed, and data obtained with it are reviewed. The presence of electron fluxes with energies from 10 to 1000 MeV in the stratosphere and at heights up to 1000 km is observed and attributed to albedo particles generated in the atmosphere by primary cosmic rays. (IAA)

17776 PARTICLE DENSITY OF THE COSMIC RAYS. Jatczak, J. Postepy Astronaut.; 5: 5-21(1972). (In Polish).

The determination of the density of particles in extensive air shower of cosmic radiation is discussed. The equation for the calculation of the most probable and logarithmic density of particles is given. There is calculated the value of logarithmic density of particles in the function of the number of hit detectors and the exponent γ of the density spectrum of EAS. (auth)

17777 DO SUPERNOVA REMNANTS PROVIDE THE COSMIC–RAY ELECTRONS? Dickel, J.R. (University of Illinois Observatory, Urbana). Astrophys. J. 193: No. 3, 755-757 (1 Nov 1974).

Analysis of recently improved parameters of the radio structure and evolution of supernova remnants (SNRs) has allowed us to determine the total radio luminosity of the relativistic electrons from all the SNRs in the Galaxy. Although the results are uncertain to within a factor of almost 10, the radio luminosity of all the electrons which have escaped from the old SNRs appears to be equal to that of the general galactic background. This suggests that the SNRs provide the cosmic–ray electrons in the Galaxy. (auth)

17778 A VARIATIONAL APPROACH TO CHARGED–PARTICLE TRANSPORT. Lerche, I. (Enrico Fermi Institute and Department of Physics, University of Chicago). Astrophys. J. 193: No. 3, 711-719 (1 Nov 1974).

The equations describing the transport of charged particles in turbulent electromagnetic fields are investigated from a variational point of view. We demonstrate that (i) the transport equation (which is normally not self–adjoint) follows from an extremal variation of a Lagrangian; (ii) the equations adjoint to the transport equation also follow from an extremal variation of the same Lagrangian; (iii) the Lagrangian approach automatically gives a variational principle for computing the eigenvalues of the transport equation subject to the boundary conditions at hand; (iv) the quasi–linear approximation follows by neglecting a single term in a Lagrangian for the self–adjoint Liouville's equation, and neglect of this term turns the self–adjoint equation into a non–self–adjoint equation. In view of the paucity of analytic solutions (and their eigenvalues) to the transport equation for complicated media (like the solar wind and the interstellar medium), we believe that the technique developed here—which is capable of handling complicated media and which does not have any numerical convergence problems—is a valuable addition to the methods used for discussing charged–particle transport in astrophysical situations. (auth)

17779 COMPOSITION OF HEAVY COSMIC RAYS FROM 25 TO 180 MeV PER ATOMIC MASS UNIT. Fleischer, R.L.; Hart, H.R. Jr.; Renshaw, A. (General Electric Research and Development Center, Schenectady, New York). Astrophys. J. 193: No. 3, 575-577 (1 Nov 1974).

Relative abundances of elements from neon through zinc in the energy range 25–180 MeV amu^{-1} have been determined from particle tracks in polycarbonate detectors exposed on the Apollo 16 mission. The ratios of elemental abundances of Ne+Si and $17<Z<25$ to Fe+Co+Ni are found to be 5.8 ± 1.9 and 2.1 ± 0.7, respectively, in agreement with the results from cellulose triacetate detectors by O'Sullivan, Thompson, and Price. Our results imply that the heavy particles observed are predominantly galactic in origin. The availability to investigators of unetched plastic detectors exposed to solar–flare particles on the Apollo 16 mission is noted. (auth)

17780 THE DIFFUSIVE IDEALIZATION OF CHARGED–PARTICLE TRANSPORT IN RANDOM MAGNETIC FIELDS. Earl, J.A. (Department of Physics and Astronomy, University of Maryland, College Park). Astrophys. J. 193: No. 1, 231-242 (1 Oct 1974).

This paper examines the uniqueness and accuracy of the equations which describe the transport of charged particles diffusing in a random magnetic field parallel to a relatively large guiding field. With regard to uniqueness, it is found here that the same coefficient of diffusion is obtained by three methods that have apparently led to discrepancies in previous work. With regard to accuracy, it is found that two corrections must be added to Fick's law in which the diffusive flux is proportional to the gradient of the density. If the temporal derivative of the flux is large, the first of these corrections is important and the diffusion equation must be replaced by the telegrapher's equation. If the gradient of the flux is large, the second correction is important and the appropriate generalization of the diffusion equation is an integral equation analogous to those invoked in classical transport theory. Explicit expressions are given for a characteristic time and a characteristic length which describe the corrections. The well–known divergence of the coefficient of diffusion, which is implied by the quasilinear analysis of pitch–angle scattering, does not occur if the scattering rate is finite at 90° pitch angle. This effect is illustrated by formulae which give the coefficient of diffusion when the quasilinear expression is perturbed by a variable amount of isotropic scattering. (auth)

17781 OBSERVATION OF A COSMIC GAMMA–RAY BURST ON APOLLO 16. I. TEMPORAL VARIABILITY AND ENERGY SPECTRUM. Metzger, A.E.; Parker, R.H. (Jet Propulsion Laboratory); Gilman, D.; Peterson, L.E.; Trombka, J.I. Astrophys. J. Lett. 194: No. 1, L19-L25 (15 Nov 1974).

A cosmic γ–ray event occurring 1972 April 27 at 10:58 UT was observed by γ–ray and X–ray spectrometers on Apollo 16 as well as by Vela 6A. Analysis has yielded a detailed time profile of the entire event, an energy spectrum covering three orders of magnitude (2.0–7.9 keV and 0.067–5.1 MeV) and a source location. A well–defined onset prior to the main impulse period and a probable precursor are reported. The total energy of the event over the observed range was 2×10^{-4} ergs cm^{-2}. The spectrum may be fitted by two power–law functions: from 2 keV to 200 keV with an exponent α of 1.4, and from 0.3 to 3 MeV with an α of 2.6. An exponential response may be fitted from 70 keV to 1 MeV but is unsatisfactory above 1 MeV. An excess of flux between 3 and 5 MeV, and evidence of a flux above 5 MeV, are seen. The data indicate the presence of a hard component which persists during the entire event, with a softer variable component becoming dominant during the most explosive burst portion. No line components are visible, and upper limits have been calculated as $0.05\gamma\ cm^{-2}\ s^{-1}$ and $0.1\gamma\ cm^{-2}\ s^{-1}$ at 0.51 MeV and 2.23 MeV, respectively. The data are not inconsistent with either accretionary or stellar flare models of production. No other event as much as one–quarter as intense was seen during the 322–hr data record from Apollo 15 and 16. (auth)

17782 OBSERVATION OF A COSMIC GAMMA–RAY BURST ON APOLLO 16. II. X–RAY TIME PROFILE AND SOURCE LOCATION. Trombka, J.I.; Eller, E.L.; Schmadebeck, R.L. (Goddard

Space Flight Center); Adler, I.; Metzger, A.E.; Gilman, D.; Gorenstein, P.; Bjorkholm, P. Astrophys. J. Lett. 194: No. 1, L27-L33 (15 Nov 1974).

During the cislunar flight period of Apollo 16, a transient burst of X−rays was detected by the X−ray spectrometer aboard the spacecraft which corresponded exactly in time and closely in duration with a γ−ray event detected by the Apollo 16 γ−ray spectrometer. The event was also observed by the Vela 6A satellite. Differential energy spectra at 8^s intervals were obtained from 2.0 keV to 7.9 keV. These show the most intense time period to have a harder spectrum over this energy region than the preceding and following periods. The 60° field of view of the X−ray spectrometer permits localization of the source position. A better source direction has been obtained by a comparison of the ratio of the X−ray and γ−ray intensities observed in successive 8^s counting periods during the event, and from the timing cone established by the Vela 6A and Apollo 16 γ−ray spectrometer instruments. The resultant region of most likely direction is centered at $22.^h9$ in α and $-68°$ in δ. (auth)

17783 THE EFFECT OF REPEATED COMPTON SCATTERINGS ON THE DIFFUSE X−RAY BACKGROUND. Felten, J.E. (Steward Observatory, University of Arizona); Gould, R.J. Astrophys. J. Lett. 194: No. 1, L39-L42 (15 Nov 1974).

Recent Monte Carlo computations, based on a speculative extrapolation of the electron spectrum, suggested that repeated scatterings contribute most of the extragalactic X−ray background around 3 MeV in a Compton model. We have redone this calculation analytically with a similar electron spectrum, but with very different results. The double−scatter contribution near 3 MeV does not exceed 1 percent and cannot improve the fit to data. The effect is largest near 1 keV but will probably not be observable. (auth)

17784 ENERGY SPECTRUM OF THE STEADY CURRENT OF SOLAR COSMIC RADIATION AND ITS VARIATION WITH TIME. Kobzev, V. A.; Kolomeets, E. V. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 4, 63-66(1974). (In Russian).

The energy spectra of the steady current of solar cosmic radiation were examined. It was shown that the energy spectra of the solar cosmic particles are described by a power function and the upper limits of the spectra are shifted to the high energy region with increase of the solar activity. The energy spectra of the steady current of solar protons with decrease of energy becomes hard and is similar to the spectra of galactic cosmic radiation. An hypothesis was given on the origin of the steady current of electrons for different energy intervals. (tr-auth)

17785 MULTICORES IN EXTENSIVE AIR SHOWERS. Stanev, T.; Markovski, B. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 5, 1007-1012(May 1974). (In Russian).

From all-union conference on cosmic ray physics; Kharkov, USSR (25 Sep 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

Comparative studies were made of the characteristics of showers with normal and abnormal structure of the electron−photon cores. Muons can be the cause of the appearance of secondary cores, whose supplementary energy is approximately evaluated for $\delta = 1.3$ at $>6 \times 10^4$ GeV. The processes which can explain the multicores of extensive air showers are discussed. (JSR)

17786 TIME VARIATIONS IN THE COSMIC RAY INTENSITY DURING A PERIOD OF ENHANCED SOLAR ACTIVITY ACCOMPANIED BY MODERATE DISTURBANCES OF THE GEOMAGNETIC FIELD IN JANUARY 1959. Oestman, B.; Shutrasakul, L.; Yadav, R. S. (Uppsala Univ.). Ark. Geofys.; 5: No. 6, 529-547(1974).

A decrease of the cosmic-ray intensity occurring in Jan. 1959 was studied. Two methods were used for the calculations, namely a method of smoothing and a method calculating a "planetary" intensity level. The intensity drop was a function of threshold rigidity and the rate of the recovery showed to be dependent on time. The daily variation was studied from data recorded by neutron monitors in separate parts of the world. A distinct shift of the phase (time of maximum) indicated a change of the direction of anisotropy. The direction of anisotropy which normally (during quiet conditions) is 90 degrees east of the Sun−Earth line shifted to the night sector a few days before the decrease. After the first stage of the decrease the direction of anisotropy returned to a normal value and a rise of the amplitude of the daily variation occurred. These results are compared to a theory as suggested by Axford (1965) on the basis of Parker's solar wind model (1963). (auth)

17787 PRODUCTION OF ^{7}Be AND ^{32}P IN THE AIR AND THE USE OF THEIR ACTIVITY RATIO. Marenco, A.; Fontan, J. (Univ., Toulouse). Tellus; 26: No. 3, 376-385(1974). (In French).

A study of the values of the ^{7}Be/^{32}P activity ratio, measured during several years by means of short time samplings, shows that the production efficiency of ^{32}P by cosmic rays in the atmosphere has very likely been underestimated and that one should consider a corrected value of about 37 for the ratio between the production rates of ^{7}Be and ^{32}P. Moreover, the theoretical studies by simulation on models and the experimental results obtained at Toulouse show the important influence of vertical movements of air upon the variation of the ^{7}Be/^{32}P ratio in the troposphere. (auth)

17788 ATMOSPHERIC PROPAGATION OF FAST NUCLEAR PARTICLES. Barashenkov, V. S.; Sdobnov, V. E.; Chigrinov, S. E. Sov. At. Energy (Engl. Transl.); 36: No. 3, 278-280(Mar 1974).

Translated from At. Energ. (USSR); 36: No. 3, 224-225(Mar 1974).

A program which makes it possible to calculate the propagation of nuclear particles in extended gaseous media by the Monte-Carlo method for particle energies from several tens of MeV to several hundred GeV was developed at JINR. In order to illustrate the accuracy of the program, the important case of the atmospheric propagation of primary cosmic radiation is considered. (WDM)

17789 RECOVERY RATE AND THE ENERGY DEPENDENCE OF DECREASES OF THE COSMIC RAY INTENSITY DURING THE YEARS 1957 THROUGH 1959. Oestman, B. (Uppsala Univ.). Ark. Gwofys.; 5: No. 6, 549-568(1974).

The recovery of most of the decreases of the cosmic-ray intensity as recorded by neutron monitors during 1957 through 1959 were studied. Two data sets were used for the calculations, namely one resulting from smoothing and the other employing the "planetary" intensity level. The intensity drop is a function of threshold rigidity. Calculating a mean dependence of energy for all decreases gives no definite function due to the spread of the data. This indicates a different energy dependence from one storm to another. A straight line was chosen as representing the mean integral spectrum indicating a quite flat differential spectrum with a mean rigidity of 10 BV and a cut-off above 20 BV. The recovery rate showed to be dependent of time for several decreases. An expression for the relative particle loss caused by a decrease is suggested and compared to the intensity of the responsible flare and Type IV emission suggested by Kamiya (1972). The results are compared to the models of modulation mechanisms as suggested by Alfven (1956), Dorman (1960), Cocconi et al. (1956) and Parker (1963). (auth)

17790 COSMIC GAMMA-RAY BURSTS. Fabian, A.; Pringle, J. (Inst. of Astronomy, Cambridge, Eng.). New Sci.; 65: No. 935, 313-315(6 Feb 1975).

The detection and properties of the cosmic gamma-ray bursts are reviewed. Possible origins for these bursts are briefly discussed. (WDM)

17791 IZUCHENIE KOSMICHESKIKH LUCHEI NA ISKUSSTVENNYKH SPUTNIKAKH ZEMLI. (Study of Cosmic Radiation on Artificial Earth Satellites). Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). 172p.

A collection of seven articles dealing with specific cosmic ray studies on space vessels and questions of methodology of cosmic ray measurements are compiled. Separate abstracts were prepared for each. (JSR)

For abstracts of individual papers see: 16643, and 17792−17797.

17792 PERSPECTIVES FOR THE STUDY OF HIGH ENERGY COSMIC PARTICLES ON ARTIFICIAL EARTH SATELLITES. Grigorov, N. L. pp 3-9 of Izuchenie Kosmicheskikh Luchei Na Iskusstvennykh Sputnikakh Zemli. Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

The principal questions of methodology for the study of cosmic particles of superhigh energy (energy range from 10^{10} to 10^{15} eV) were examined and it was indicated that such particles can be observed and studied by direct methods with satisfactory statistical frequency only beyond the limits of the Earth's atmosphere by means of heavy artificial satellites. On the basis of results obtained from Proton-1, 2, and 3, specific problems of the physics of high-energy particles and cosmic-ray physics were examined. Some methods of experimental study of these problems by the use of satellites are discussed. (tr-auth)

17793 STUDY OF THE ENERGY DISTRIBUTION OF PRIMARY COSMIC PARTICLES IN THE ENERGY RANGE FROM 10^{10} TO 10^{14} eV ON THE SPACE VESSELS PROTON-1, 2, AND 3. Grigorov, N. L.; Nesterov, V. E.; Rapoport, I. D.; Savenko, I. A.; Skuridin, G. A. pp 34-48 of Izuchenie Kosmicheskikh Luchei Na Iskusstvennykh Sputnikakh Zemli. Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

The energy spectra of all particles of primary cosmic radiation were measured on Proton-1, 2, and 3 in the energy interval from 10^{10} to 10^{14} eV and the energy spectra of protons in the energy region from 10^{10} to 10^{13} eV. The measured spectra of all particles is stepped in all energy intervals. The energy spectra of protons becomes very steep at 10^{12} to 10^{13} eV. The calculated spectra of nucleons at different depths of the atmosphere, based on the primary cosmic spectra obtained on Proton-1, 2, and 3, agree with the spectra of γ radiation, neutrons, and nuclear-active particles measured at those atmospheric depths. (tr-auth)

17794 APPARATUS FOR STUDY OF COSMIC RADIATION ON THE PROTON-4. Grigorov, N. L.; Rapoport, I. D.; Savenko, I. A.; Kalinkin, L. F.; Kakhidze, G. P. pp 49-94 of Izuchenie Kosmicheskikh Luchei Na Iskusstvennykh Sputnikakh Zemli. Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

A detailed methodic description is given of the experiments for the study of high-energy primary cosmic radiation made on board the Proton-4. The instrument for the registration of particles with $\gtrsim 10^{11}$ eV contained an ionization calorimeter with Pb and Fe absorbers of a total thickness of ~7.5 the mean free path for nuclear interactions, two large-area Cherenkov detectors for determination of the charge of the particles, C and polyethylene targets, and nuclear interaction detectors. By means of these apparatus it was possible to study the energy and charge spectra of particles up to 10^{15} eV and to measure the effective cross section for the inelastic interaction of protons with light and heavy nuclei. Two other devices were available for recording the electron component for searching for fractionally charged particles. (tr-auth)

17795 HIGH ENERGY ELECTRONS IN THE STRATOSPHERE. Bezus, V. A.; Gal'per, A. M.; Grigorov, N. L.; Dmitrenko, V. V.; Kalinkin, L. F.; Kirillov-Ugryumov, V. G.; Luchkov, B. I.; Melioranskii, A. S.; Savenko, I. A.; Shermanzon, E. M. pp 112-125 of Izuchenie Kosmicheskikh Luchei Na Iskusstvennykh Sputnikakh Zemli. Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

The results of the experimental investigation of the intensity and energy spectra of direct (to the Earth) and albedo (from the Earth) electrons with energy above 100 MeV at different altitudes in the atmosphere are reported. The measurements were made at the geomagnetic latitude of 46°N where the cutoff hardness is 3.5 GeV/c. The experiment was made during 1967-68 in high-altitude balloons by means of instruments with multilayer spark chambers. At low altitudes ($h \lesssim 50$ g/cm^2) an effect of large variation (by a factor of 2 to 3) of the direct electron current correlated with the condition of the magnetosphere was observed. The effect is explained on the basis of the assumption of the existence in the magnetosphere of captured electrons with energy greater than 100 MeV released during disturbance of the magnetic field. The intensity of the released electron current in the energy interval from 100 to 1500 MeV was $(6.2 \pm 0.8) \times 10^{-2}$ (cm^2 sec $\cdot$ ster)$^{-1}$. The exponent of the differential energy spectra of the released current is 1.56 ± 0.22. (tr-auth)

17796 CHEMICAL COMPOSITION AND ENERGY SPECTRA OF GALACTIC COSMIC RADIATION ON ARTIFICIAL EARTH SATELLITES. Grigorov, N. L.; Volodichev, N. N.; Savenko, I. A.; Suslov, A. A. pp 126-137 of Izuchenie Kosmicheskikh Luchei Na Iskusstvennykh Sputnikakh Zemli. Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

The results of the measurement of the current of groups of nuclei of primary radiation with energy ~10^9 to 10^{10} eV, obtained on Proton-2 with Cherenkov spectrometers with zero shading of the instrument by the Earth are reported and discussed. Data on the stable operation of the instrument made it possible to average the results obtained over a wide time period. The values of the intensity for the nuclear groups exceeded by a factor of two and more the intensity measured by a series of investigations primarily in balloons during the same period. On the other hand in studies carried out on sputniks and space probes the intensities of particles with $Z \geq 1$ and $Z \geq 2$ were close to the intensity measured on the Proton-2 in the hardness interval ≥1 to 2 GeV/c. The studies were made in the second half of 1965. The merits and deficiencies of the Cherenkov-scintillation method used and prospects for the future study of nuclei current of primary cosmic radiation were examined. (tr-auth)

17797 METHODS OF PROCESSING SCIENTIFIC DATA FROM THE PROTON SPACE STATION. Akimov, V. V.; Beletskii, V. V.; Golubkov, V. V.; Zlotin, G. N.; Karmanov, S. I.; Kirknadze, I. N.; Nesterov, V. E.; Pokras, V. M.; Prokhin, V. L.; Rapoport, I. D.; Khatskevich, I. G. pp 138-168 of Izuchenie Kosmicheskikh Luchei Na Iskusstvennykh Sputnikakh Zemli. Grigorov, N. L. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

The operational characteristics of the measurement-data complex of the Protons were determined by the problem of designing a processing system and its mathematical reliability. The development of methods and algorithms for the processing of scientific data, which would make the automatic processing of data possible to a large degree, was necessary. The general circuits of the data processing system consists of a series of units: the selection and systematization of material, data input, obtaining survey registrations, processing and delivery of telemetry signals of the scientific and navigational instruments. The methods for the statistical processing of magnetometric data and for the determination of the orientation of the vessel are discussed in detail. Processing the readings of the scientific instruments with consideration of their position in space is the basic result of the first data processing. (tr-auth)

17798 SOLAR WIND AND COSMOGENIC RARE GASES IN LUNA 16 AND 20 SOILS AND THEIR CORRELATION WITH COSMIC RAY PRODUCED FOSSIL TRACKS IN LUNAR SAMPLES. Agrawal, J. K.; Gopalan, K.; Rao, M. N. (Physical Research Lab., Ahmedabad, India). Pramana; 3: No. 3, 176-185(Sep 1974).

The elemental and isotopic composition of Ne, Ar, Kr and Xe were measured in the bulk soil samples obtained from Luna 16 and 20 missions. The average cosmic ray exposure ages for the Luna 16 soils is higher than that of Luna 20 soils. The trapped solar wind composition is deduced by correcting for the cosmogenic component and is found to be in good agreement with the values published by others. The correlation between the solar wind gases and cosmic ray tracks in lunar samples is quantitatively studied and some systematic features regarding lunar regolith dynamics are tentatively established. (auth)

Stars

Refer also to abstracts 17946, 18012, 18039, 18044, 18048, 18269, and 18474.

17799 (AD-779922) OBSERVATION OF H 42 ALPHA IN ORION A. Waltman, W. B.; Waltman, E. B.; Schwartz, P. R.; Johnston, K. J.; Wilson, W. J. (Aerospace Corp., El Segundo, Calif. (USA)). 14 May 1974. Contract F04701-73-C-0074. 10p. (SAMSO-TR-120). NTIS $3.00.

The H 42 alpha (85.6884 GHz) line was observed in Orion A and found to be stronger in intensity than non-LTE theory predicts for a spherically symmetric model H II region. (auth)

17800 (INIS-mf-1385) SPECTROGRAPHY AND INFRARED PHOTOMETRY OF THE HD 45677 STAR AND OTHER SPECIAL LINE EMITTING OBJECTS. Swings, J. P. (Liege Univ. (Belgium). Inst. d'Astrophysique). 1974. 105p. (In French). INIS. Thesis.

The spectra of the star HD 45677 is described in detail. A physical model of the extended atmosphere is proposed on the basis of the profiles of certain emission rays. It seems probable that an equatorial ring in rotation exists around the star. The infrared data and the origin of the important infrared excess observed were studied. It was shown that infrared photometry leads to the discovery of objects with particular spectra. The interpretation of the spectra of stars or of particular nebulae with emission rays is facilitated when the transition probabilities of the emission rays are known. (tr-auth)

17801 PREDETONATION LIFETIMES OF TYPE II SUPERNOVAE. Biermann, P. (Univ.-Sternwarte, Goettingen, Ger.); Tinsley, B. M. (Publ. Astron. Soc. Pac.; 86: No. 513, 791-794 (Oct 1974).

Since Type II supernovae tend to occur near the inner edges of spiral arms (Moore 1973), an upper limit to the precursor lifetimes, and hence a lower limit to the precursor masses, can be set. Moore derived a limit of 35 $M_\odot$, on the assumption of constant stellar velocity across the arm; this mass is too great to agree with supernova statistics or theoretical predictions. Here the motion of the stars across the arm under the influence of the spiral gravitational field is considered and a limit of about 8 $M_\odot$ is found which does agree with other estimates. However, the computed stellar orbits make it difficult to believe that supernovae are as tightly clustered to the inner edges as claimed by Moore. (auth)

17802 UBV PHOTOMETRY OF 180 EARLY-TYPE STARS. Guetter, H. H. (Naval Observatory, Flagstaff, AZ). Publ. Astron. Soc. Pac.; No. 513, 795-797(Oct 1974).

Photoelectric UBV photometry is presented for 180 O-, B-, and A-type stars. (auth)

17803 STUDY OF THE YOUNG CLUSTER IC348. Strom, S. E. (Kitt Peak National Observatory, Tucson); Carrasco, L. Publ. Astron. Soc. Pac.; 86: No. 513, 798-805(Oct 1974).

Optical and infrared photometry has shown that IC 348 is a relatively young cluster of age 0.5 to 2×10^7 years. Star formation has probably taken place over a significant fraction of the cluster age. The ratio of total-to-selective extinction in the dark cloud associated with IC 348 appears to be higher than the value typical of the interstellar medium. This result supports the view that the mean grain size in dense, dark cloud regions is increased as a result of heavy element accretion. The dark cloud contains at least one heavily obscured, luminous star, a result which suggests that the visible cluster may represent only a small fraction of the stars formed in this region. (auth)

17804 SILICON MONOXIDE RADICAL AND THE ATMOSPHERE OF α ORIONIS. Beer, R.; Lambert, D. L.; Sneden, C. (Univ. of Texas, Austin). Publ. Astron. Soc. Pac.; 86: No. 513, 806-812(Oct 1974).

New molecular constants, line positions, and transition probabilities are presented for the first-overtone vibration–rotation bands in the $X^1\Sigma^+$ electronic ground state of SiO, together with an estimate of the SiO abundance and silicon isotope ratios in the atmosphere of α Ori. (auth)

17805 SCANNER OBSERVATIONS OF SELECTED COOL STARS. Faye, T. D. Jr.; Stein, W. L.; Warren, W. H. Jr. (Indiana Univ., Bloomington). Publ. Astron. Soc. Pac.; 86: No. 513, 772-790(Oct 1974).

Photoelectric spectral scans at 30 Å resolution of nine dwarfs, ten giants, and six supergiants with spectral types G0 to M5 are presented. (All stars were observed every 4 Å from λ3300 to λ7000.) Absorption features observed at this resolution coincide with: strong atomic lines of Fe I, Fe II, Ca I, Ca II, Mg I, and Na I; vibrational bands of the electronic transitions of TiO, MgH, CaH, SiH, AlH, CN, CH, C_2, OH, and NH. The dependences of the λ3740 Fe I blend and the λ3440 depression on temperature are discussed. (auth)

17806 PHOTOMETRIC AND SPECTROSCOPIC SURVEY OF LARGE PROPER-MOTION STARS. Rodgers, A. W.; Eggen, O. J. (Australian National Univ., Canberra). Publ. Astron. Soc. Pac.; 86: No. 513, 742-766(Oct 1974).

Spectroscopic, kinematic, and photometric data for some 200 LFT stars are presented. Eleven white dwarfs are found in the survey and two new candidates are added to a possible group of white dwarfs. Most of the remaining stars are M dwarfs of the old-disk and halo populations. The kinematic differences between these populations are reflected in the spectral lines of the halo stars where $[M/H] > -1$. (auth)

17807 He II λ 4686 LINE-PROFILE VARIATIONS IN THE SPECTRUM OF THE WOLF–RAYET STAR HD 50896. Schmidt, G. D. (Univ. of Iowa, Iowa City). Publ. Astron. Soc. Pac.; 86: No. 513, 767-768(Oct 1974).

The He II λ4686 profile of HD 50896 was observed on ten nights between November 1973 and February 1974. Significant changes in the shape of the emission line were noted during the course of the observations. (auth)

17808 POSSIBLE NEARBY F AND G DWARFS. McAlister, H. A.; Ianna, P. A. (Univ. of Virginia, Charlottesville). Publ. Astron. Soc. Pac.; 86: No. 513, 769-771(Oct 1974).

Spectroscopic parallaxes were determined for 205 F and G dwarf stars lying between $+10° < \delta < 30°$. Of 46 stars with spectroscopic parallaxes greater than 0.04″, 18 were found to have no previously determined trigonometric parallaxes. Two of these stars may be within 15 pc. This suggests that the present knowledge of the relative populations of these types in the solar vicinity may require further investigation. (auth)

17809 LUMINOSITY LAW FOR LATE-TYPE MAIN-SEQUENCE STARS IN THE SOLAR NEIGHBORHOOD. Eggen, O. J. (Australian National Univ., Canberra). Publ. Astron. Soc. Pac.; 86: No. 513, 697-741(Oct 1974).

Two thousand RI and 1700 UBV observations have been obtained for stars in northern (Vyssotsky and collaborators) and southern (Upgren and collaborators) spectrophometric surveys for K and M dwarfs. A comparison of the two surveys leads to the conclusion that the northern survey is nearly complete to $V_E = 10.0$m and for stars redder than $(R - I) = +0.45$m(K4 – 5) between the equator and the North Celestial Pole. These stars, plus a few supplementary objects mainly too bright for the survey, constitute northern sample I; and, except for a few objects without radial velocity or parallax determinations, the astrometric and photometric data are essentially complete. The southern survey also seems to be complete to $V_E = 10.0$m for stars with $(R - I)$ between +0.35m(K2 – 3) and +0.65m but there is an increasing deficiency of stars with increasing color. The astrometric data available for the northern sample I permit a distinction between young- and old-disk-population stars and, although the luminosity law shows a steep rise in the numbers of old-disk stars with decreasing luminosity, that for the young-disk objects indicates a flatter distribution of stars. A well-defined mass–luminosity relation derived from binaries in both samples gives a total mass density of $0.008M_\odot$ pc^{-3} in the solar neighborhood contributed by main-sequence stars in the luminosity range of $M_{Bol} = +6.5$m to +8.4m. The lack of halo stars in the sample is discussed in connection with some candidates for inclusion. (auth)

17810 COLOR INDICES OF HR 1653. Bringans, R. D.; Sullivan, D. J.; Trodahl, H. J. (Victoria Univ., Wellington, New Zealand). Publ. Astron. Soc. Pac.; 86: No. 513, 693-696(Oct 1974).

Monochromatic color indices of the δ Scuti star HR 1653 were measured at wavelengths between 3500 Å and 7000 Å. It was found that the light variations are greater at short wavelengths, in common with other stars of this type. (auth)

17811 PHOTOELECTRIC OBSERVATIONS OF 32 CYGNI. Bloomer, R. H. Jr.; Wood, F. B. (Univ. of Florida, Gainesville). Publ. Astron. Soc. Pac.; 86: No. 513, 689-692(Oct 1974).

Narrow-band observations of 32 Cyg during and after the 1971 eclipse are presented and briefly discussed. A comparison with similar observations made at the Tokyo Astronomical Observatory shows the value of the use of identical narrow-band filters in observing systems of this type. (auth)

17812 EVIDENCE FOR A PERIOD CHANGE IN CG CYGNI. Milone, E. F.; Ziebarth, K. E. (Univ. of Calgary, Alberta). Publ. Astron. Soc. Pac.; 86: No. 513, 684-688(Oct 1974).

Observations of the eclipsing binary CG Cygni have been used to determine phases of minimum using Hertzsprung's method. Prior to 1967 the period seems to have been 0.63114347d; after 1967 the data fit a period of 0.63114100d. The effect of asymmetry in the minimum is discussed and found to be insufficient to alter the conclusion that there is evidence for a period change occurring between 1965 and 1967. (auth)

17813 RADIAL VELOCITY VARIATIONS OF HR 6684. Pike, C. D. (Univ. of California, Santa Cruz). Publ. Astron. Soc. Pac.; 86: No. 513, 681-683(Oct 1974).

Photometric and spectroscopic observations of HR 6684 confirm the photometric period of 0.139890 day and show a well-defined velocity variation with an amplitude of 11.3 km sec^{-1} in the same period. (auth)

17814 ELLIPSOIDAL SYSTEM BD + 56°2190. Burke, E. W. Jr. (King Coll., Bristol, TN); Abt, H. A. Publ. Astron. Soc. Pac.; 86: No. 513, 677-680(Oct 1974).

BD + 56°2190 is found to be a variable with a range of 0.15m, a sinusoidal light curve, and a period of 0.5713698d. It is also found to be a spectroscopic binary with the same period. The variable linewidths indicate that the system is an unresolved double-lined nearly contact binary seen at an inclination of about 40°. The light variation is probably due to ellipsoidal distortions of the stars, rather than to eclipses. (auth)

17815 HD 99002: A NEW DELTA SCUTI-TYPE STAR. Jerzykiewicz, M. (Wroclaw Univ. Observatory). Publ. Astron. Soc. Pac.; 86: No. 513, 675-678(Oct 1974).

HD 99002 is found to be variable in yellow light with a range of about 0.030m on a time scale of a few hours. It is suggested that the star is a δ Scuti-type variable. (auth)

17816 VARIABLE RADIO EMISSION FROM CC CASSIOPEIAE AND AR LACERTAE. Gibson, D. M. (Univ. of Virginia, Charlottesville); Hjellming, R. M. Publ. Astron. Soc. Pac.; 86: No. 513, 652-660(Oct 1974).

Variable radio emission from the massive binary system CC Cas has been detected at frequencies of 2695 and 8085 MHz. The CC Cas radio source was found to be present at levels of 0.005 to 0.01 Jy on one-third of the days the star was observed. The radio star AR Lac has been observed to undergo a relatively strong radio flare event of the Algol type. Detailed observations of this event at 2695 and 8085 MHz are presented together with a history of the radio emission from this binary. AR Lac and CC Cas are compared with four other binaries showing radio emission varying on short time scales: β Per (Algol), β Lyr, b Per, and HDE 226868 (Cyg X-1). (auth)

17817 O8 ECLIPSING BINARY DN CASSIOPEIAE AND THE NEW VARIABLE HD 14817. Frazier, T. H.; Hall, D. S. (Vanderbilt Univ., Nashville, TN). Publ. Astron. Soc. Pac.; 86: No. 513, 661-667(Oct 1974).

New UBV photometry of DN Cas indicates eclipse depths in V of 0.4m and 0.3m and an ephemeris for the primary of JD 2441388.571 + 2.310955d E. Since the new period is twice that of Hoffmeister, DN Cas is no longer a curiosity in the period-spectrum diagram of EA variables. The comparison star HD 14817 = ADS 1833 AB was discovered to be variable, an eclipsing binary with an Algol-type light curve, eclipse depths in V of 0.22m and 0.20m, durations of $\theta_e = \pm 0.06P$, and an ephemeris for the primary of JD 2441357.560 + 1.58064d E. (auth)

17818 EXPANSION AND POSSIBLE STRUCTURE OF THE PLANETARY NEBULA NGC 2440. Kaler, J. B. (Univ. of Illinois, Chicago); Aller, L. H. Publ. Astron. Soc. Pac.; 86: No. 513, 635-638(Oct 1974).

Radial velocities were measured along the major axis of NGC 2440, which show that the outer knots do not lie on a line with the inner condensations. The observations suggest that the bright inner nebula is expanding faster than the faint outer halo, and that these two parts of the nebula were produced independently of one another. The nebula shows an extreme degree of stratification. (auth)

17819 LOCATION OF THE EXTINCTION IN NGC 7027. Osterbrock, D. E. (Univ. of California, Santa Cruz). Publ. Astron. Soc. Pac.; 86: No. 513, 609-611(Oct 1974).

From American Astronomical Society meeting; Tucson, AZ (4 Dec 1973).

Coudé spectrograms of NGC 7027 were obtained at sufficiently high dispersion to resolve the Hα, Hβ, and Hγ line profiles. Comparison of the blue and red sides shows no differences that can be attributed to internal extinction by dust within this planetary nebula. (auth)

17820 CONJECTURE REGARDING THE dMe STARS. Worden, S. P. (Univ. of Arizona, Tucson). Publ. Astron. Soc. Pac.; 86: No. 513, 595-598(Oct 1974).

From summer meeting of the Astronomical Society of the Pacific; Bishop, CA (11 Jun 1974).

dMe stars are late-type main-sequence objects which exhibit characteristics that can be explained as the result of solar-type surface magnetic activity. The battery mechanism of Biermann (1950) is used to explain the origin of the magnetic fields responsible for the surface activity. Magnetic fields 10 to 100 times the strength of solar magnetic fields can be produced in this manner. Such strong fields are consistent with the observed dMe properties and should be directly detectable. (auth)

17821 NONSPHERICAL OSCILLATIONS IN o CETI. Shawl, S. J. (Univ. of Kansas, Lawrence). Publ. Astron. Soc. Pac.; 86: No. 513, 843-844(Oct 1974).

Arguments are presented showing that photometric and spectroscopic observations of Mira are consistent with the hypothesis of nonspherical oscillations. (auth)

17822 CLASSIFICATION OF BLACK HOLES WITH ELECTROMAGNETIC FIELDS. Robinson, D. C. (King's Coll., London). Phys. Rev., D; 10: No. 2, 458-460(15 Jul 1974).

Pseudostationary asymptotically flat axisymmetric black-hole solutions of the source-free Einstein-Maxwell equations are considered. It is shown that these solutions form discrete continuous families, each depending on at most four parameters, of which only one—the Kerr-Newman family—contains members with zero angular momentum. (auth)

17823 PROBLEM OF THE NEUTRINO AND THE STRUCTURE OF STARS. Vanysek, V. (Katedra Astronomie a Astrofyziky Matematickofyzikalni Fakulty UK, Prague (Czechoslovakia)). Vesmir; 53: No. 1, 16-17(1974). (In Czech).

With a view to current ideas on the evolution and inner structure of stars, the problems are dealt with of recording neutrino flux produced by nuclear processes in the sun. Principal hypotheses are presented interpreting the disagreement between the observed luminosity of the sun and the low neutrino flux from the sun. (Z.S.)

17824 COSMIC DUST IN SPACE AND ITS INVESTIGATIONS. Skowronski, A. (Akademia Gorniczo-Hutnicza, Krakow (Poland)). Postepy Astronaut.; 5: 41-50(1972). (In Polish).

The application of the rocket technique to the investigations of cosmic dust was described. The direct detecting and collecting of cosmic dust in space is possible. The received results are taken into account in the space vehicles technology. They give also interesting information in the field of cosmomineralogy and in many branches of astronomy. (auth)

17825 LINEAR SERIES OF STELLAR MODELS. Part 2. Pure Carbon Stars. Paczynski, B. (Polska Akademia Nauk, Warsaw. Zaklad Astronomii); Kozlowski, M. (Polska Akademia Nauk, Warsaw). Acta Astron.; 22: 315-325(1972).

Results of model computations are presented for pure carbon stars that are in the thermal and hydrostatic equilibria. In the case when the neutrino energy losses due to the universal Fermi interactions are neglected all the models fall on the main sequence. The main sequence is found to consist of three sections: normal, high density and white dwarf branches. A large number of other sequences of carbon stars appears in addition to the main sequence when the neutrino emission is taken into account. Models on those sequences have regions with the negative heat flux, L_r. UCRA processes were neglected in this study. The most massive white dwarf models have the time scale for nuclear evolution of the order of 10^9-10^{10} years. These stars are stable and are possible candidates for presupernovae of Type I. (auth)

17826 DISTINCTIVE PATTERNS ON THE SURFACE OF SLOWLY ROTATING STARS WHOSE OSCILLATIONS ARE NONLINEARY COUPLED. Wolff, C.L. (Laboratory for Solar Physics and Astrophysics, NASA—Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 193: No. 3, 721-727 (1 Nov 1974).

Slowly rotating stars which are oscillating at small amplitude in a broad spectrum of g—modes should display strong surface nonuniformities if even weak nonlinear coupling exists between the modes. Oscillatory power will be concentrated into distinctive patterns which rotate rigidly in spite of differential rotation in the outer stellar layers. Each pattern rotates at a constant rate slower than the star as a whole according to a very simple law of rotation. Virtually all the rotation rates are within 9 percent of the stellar rate. Evidence is cited that the Sun may be oscillating, so other stars along the main sequence may be oscillating, also. If zones obeying the predicted rotation law can be detected in a star, then the rotation rate of the stellar interior becomes known, and differential rotation is negligible over most of the stellar mass. (auth)

17827 ADVANCED EVOLUTION IN GLOBULAR CLUSTERS. I. THE ULTRAVIOLET—BRIGHT STARS IN EIGHT GLOBULAR CLUSTERS. Zinn, R. (Yale University Observatory). Astrophys. J. 193: No. 3, 593-605 (1 Nov 1974).

Thirty—eight ultraviolet—bright stars—i.e., stars that are brighter than the horizontal branch (HB) stars and bluer than the giant branch stars—in the globular clusters M3, M10, M13, M15, M53, M92, NGC 4147, and NGC 4147, and NGC 5466 have been observed spectroscopically at 130 Å mm^{-1}. Radial—velocity measurements indicate that 15 of these stars are cluster members. The radial velocity of NGC 5466 ($+115\pm4$ km s^{-1}) was measured from the spectrograms of seven red giants. It is suggested that Mayall's radial velocity for M53 should be revised to -89 km s^{-1}. The effective temperatures of the ultraviolet—bright stars and the Cepheid variables with periods longer than 1 day have been derived from their broad—band colors or taken from the few published analyses. Their luminosities have been derived from the distance moduli adopted for the clusters and from bolometric corrections taken from the literature. A detailed comparison is made between post—HB evolutionary tracks and the positions of the ultraviolet—bright stars (including the Cepheid variables) in the H—R diagram. For the most part, the theoretical tracks provide adequate explanations for the ultraviolet—bright stars. This comparison has led to the following conclusions: (i) As predicted by the theory, a strong correlation exists between the presence of supra—horizontal—branch stars in a cluster and the presence of HB stars hotter than log $T_{eff}=4.1$. (ii) The theoretical relationship between the blueness of the HB and the luminosities of the ultraviolet—bright stars with log $L/L \geqslant 2.3$ is supported by observation. (iii) The rare Population II Cepheid variables that have periods between 4 and 12 days are most likely stars that have evolved from the blue end of the HB (log T_{eff}—4.1). Therefore, their paucity is probably caused by the paucity of hot HB stars. (auth)

17828 UBVr COLORS FOR POPULATION II GIANTS. Böhm—Vitense, E.; Szkody, P. (University of Washington, Seattle). Astrophys. J. 193: No. 3, 607-620 (1 Nov 1974).

The UBVr colors for intermediate Population II giants with metal abundance $Z = 1/10$ of the solar metal abundance $Z_\odot$ are computed from radiative equilibrium models. Line blanketing and Rayleigh scattering are taken into account. The colors are given for models with $4000° < T_{eff} < 8000°K$ and $4.6 < L/L_\odot < 1800$. The relation between B—V and T_{eff} is determined for different luminosities. Graphs for T_{eff} and U—B as functions of B—V for different luminosities and metal abundances are given and compared. It is shown that the U—B excess is not a simple function of the metal abundance alone but depends on B—V and L also. A simple method is described by which luminosity, effective temperature, and metal abundance can be determined simultaneously from B—V, U—B, and M_v. (auth)

17829 THE $^{12}C/^{13}C$ RATIO IN STELLAR ATMOSPHERES. II. CN AND CO IN ALPHA ORIONIS. Lambert, D.L.; Dearborn, D.S.; Sneden, C. (McDonald Observatory and Department of Astronomy, University of Texas, Austin). Astrophys. J. 193: No. 3, 621-630 (1 Nov 1974).

The isotopic abundance ratio, $^{12}C/^{13}C$, for the M supergiant α Orionis is derived from photoelectric high—resolution scans of the CN 2—0 red system and high—resolution interferometric spectra of the CO second—overtone bands. The two molecules yield consistent results and the final result is $^{12}C/^{13}C=7.0\pm1.5$. (auth)

17830 THE $^{12}C/^{13}C$ RATIO IN STELLAR ATMOSPHERES. III. ALPHA TAURI, BETA GEMINORUM, AND MU LEONIS. Tomkin, J.; Lambert, D.L. (McDonald Observatory and Department of Astronomy, University of Texas, Austin). Astrophys. J. 193: No. 3, 631-637 (1 Nov 1974).

High–resolution photoelectric scans of portions of the 2–0 and 4–0 bands of the CN red system in the spectra of three K giants α Tau, β Gem, and μ Leo have been obtained. Analysis of the ^{12}CN and ^{13}CN line intensities provides the $^{12}C/^{13}C$ abundance ratios for these atmospheres. The results are $^{12}C/^{13}C = 12 \pm 2$ (α Tau), $= 16 \pm 2$ (β Gem), $= 18 \pm 2$(μ Leo). (auth)

17831 THE PECULIAR A STAR HD 168733. II. A MODEL ATMOSPHERE ANALYSIS. Little, S.J. (University of California, Los Angeles). Astrophys. J. 193: No. 3, 639-645 (1 Nov 1974).

A detailed abundance analysis of the Ap star HD 168733 (HR 6870) has been carried out with hydrogenline–blanketed model atmospheres. The best fit to the energy scans and hydrogen–line profiles is obtained with $T_e = 14{,}500°K$, and $\log g = 3.6$. Carbon and nitrogen are shown to be overabundant as compared with the Sun, while magnesium, silicon, and sulfur are approximately solar in abundance. The iron–peak elements are generally overabundant by factors of 1.0 dex, with titanium enhanced by as much as 4.0 dex. Chlorine and strontium are enhanced by about 2.0 dex as compared with the Sun. (auth)

17832 PARALLAX, ORBIT, AND MASS OF THE BINARY STAR 70 OPHIUCHI. Worth, M.D.; Heintz, W.D. (Sproul Observatory and Department of Astronomy, Swarthmore College, Swarthmore, Pennsylvania). Astrophys. J. 193: No. 3, 647-650 (1 Nov 1974).

Plates taken with the Sproul refractor over the interval 1914–1971 give a relative parallax of $+0''.207 \pm 0''.007$ (p.e) and a fraction mass $f = 0.445 \pm 0.003$. With combined values for π and f, and a revised orbit ($P = 88.13$ yr; $a = 4''.545$; $K_1 = 3.3$ km s^{-1}), component masses $A = 0.81\ M_\odot$ and $B = 0.64\ M_\odot$ are obtained. The lack of evidence for a third body is sustained. (auth)

17833 TRANSFER OF LINE RADIATION IN DIFFERENTIALLY EXPANDING ATMOSPHERES, IV: THE TWO–LEVEL ATOM IN PLANE PARALLEL GEOMETRY SOLVED BY THE FEAUTRIER METHOD. Noerdlinger, P.D. (Michigan State University, East Lansing); Rybicki, G.B. Astrophys. J. 193: No. 3, 651-676 (1 Nov 1974).

We have solved the radiative transfer problem for a two–level atom in plane–parallel geometry in an expanding atmosphere with Schuster–type boundary conditions, by applying the Feautrier method in the fluid rest frame. The line profiles are relatively smooth and very approximately symmetric about their minima, except when the temperature in the atmosphere exceeds that of the photosphere, in which case a redward emission wing appears. Radiation pressure is evaluated and is found to compress the inner part of the atmosphere and to expand the outer part. This suggests that radiation pressure will disrupt QSO absorption clouds, as found by Williams for nonexpanding clouds. The method is stable, accurate, and fast for all optical depths and expansion rates tested, which comprise a vast range. (auth)

17834 INFLUENCE OF OPACITY ON THE PULSATIONAL STABILITY OF MASSIVE STARS WITH UNIFORM CHEMICAL COMPOSITION. II. MODIFIED KRAMERS OPACITY. Sastri, V.K. (Behlen Laboratory of Physics, University of Nebraska, Lincoln); Stothers, R. Astrophys. J. 193: No. 3, 677-678 (1 Nov 1974).

The pulsational stability of massive, chemically homogeneous stars of Population I has been investigated for a range of simple opacity representations consisting of a straight sum of electron–scattering and modified Kramers opacity. The critical mass for stability against nuclear–energized pulsations is found to be extraordinarily sensitive to small changes in the coefficient and/or temperature exponent of the absorption part of the opacity law. A gradual increase in the atomic absorption (dominant near the stellar surface) first raises the critical mass, then restricts the upper mass limit for instability, and finally eliminates pulsational instability at all masses. (auth)

17835 THE 71–SECOND VARIATION OF DQ HERCULIS. Herbst, W. (David Dunlap Observatory); Hesser, J.E.; Ostriker, J.P. Astrophys. J. 193: No. 3, 679-686 (1 Nov 1974).

Photoelectric observations of the old nova DQ Her obtained at the Princeton University Observatory and Kitt Peak National Observatory have been used to determine an accurate period for the 71^s variation. By using the autocorrelation technique and a least squares method we find the period in 1969 to be $71^s.06547 \pm 0^s.00002$. This represents a significant change in the period since Walker's 1961 observations, as expected from the rate of period change we detected using data spanning the period 1967–1971. Allowing for the rate of period change, it has been possible to combine all the observations from 1954 to 1971 ($\sim 10^7$ cycles) to obtain accurate values of P and $\dot{P}$ and an estimate of $\ddot{P}$. We find that the period has been decreasing steadily on a time scale ($P/\dot{P}$) of 2.64×10^6 years; error or phase jitter as measured by the rms value of the (O–C) timing is only $4^s.3$. The extreme stability of the period compared with expected damping or evolutionary time scales makes plausible a rotational interpretation of the origin of the periodic light variations. (auth)

17836 RECOMBINATION LINES IN A PLANETARY NEBULAE AT 15 GIGAHERTZ. Bignell, R.C. (National Radio Astronomy Observatory, Charlottesville, Virginia). Astrophys. J. 193: No. 3, 687-692 (1 Nov 1974).

The H 76α radio recombination line is detected in three out of seven planetary nebulae. From these observations it is suggested that spatial variations of both temperature and density may be responsible for the observed line strengths. More sophisticated models of radio emission are required to establish the very high electron densities which have previously been implied from radio recombination–line observations. (auth)

17837 THE INFLUENCE OF DUST UPON THE DYNAMICS AND STABILITY OF PLANETARY NEBULAE. II. Hunter, J.H. Jr.; Nightingale, S.L. (Department of Astronomy, University of South Florida, Tampa). Astrophys. J. 193: No. 3, 693-698 (1 Nov 1974).

It is shown by a simultaneous integration of the nonlinear equations governing the thermal behavior of "perturbed" regions, assumed to be in pressure equilibrium with the unperturbed flow in a planetary nebula, that, following the uncoupling of the radiation field in the nebular shell with the gas, large–scale density and temperature inhomogeneities can develop between the two components due to a combination of grain and O I cooling. Furthermore, the possible development of gravitational instabilities in a nebula during the early phases of evolution are considered. (auth)

17838 SPECTRAL CHANGES INDUCED BY THE ZEEMAN EFFECT IN OBLIQUE ROTATOR MODELS. Borra, E.F. (Hale Observatories, Carnegie Institution of Washington, California Institute of Technology). Astrophys. J. 193: No. 3, 699-703 (1 Nov 1974).

Computations of line profiles for oblique rotator models show spectral variations induced by the Zeeman effect. It is found that the Zeeman effect and rotational Doppler shifts can cause asymmetries in the line profiles. The asymmetries can result in radial velocity variations. It is suggested that this effect could be used to search for magnetic fields in conditions where other methods fail. The magnetic star HD 10783 is interpreted as an example of the effect proposed. The Zeeman effect can also cause apparent changes in equivalent width. (auth)

17839 QUADRATIC ZEEMAN EFFECT IN THE HYDROGEN BALMER LINES FROM MAGNETIC WHITE DWARFS. Surmelian, G.L.; O'Connell, R.F. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge). Astrophys. J. 193: No. 3, 705-710 (1 Nov 1974).

Motivated by Preston's suggestion of using the quadratic Zeeman effect to detect large magnetic fields in DA white dwarfs, we use a variational method for an accurate calculation of the total Zeeman wavelength shifts of the hydrogen Balmer absorption lines ($H\alpha - H10$) for magnetic fields from 10^6 to 5×10^6 gauss. Interference effects between upper values of the principal quantum number n become significant in that range. The quadratic shifts are smaller than those given by perturbation theory, leading to an increase in the estimated magnetic field. (auth)

17840 NUCLEATION AND GROWTH OF DUST GRAINS. Salpeter, E.E. (Physics Department and Center for Radiophysics and Space Research, Cornell University). Astrophys. J. 193: No. 3, 579-584 (1 Nov 1974).

Classical nucleation theory must be modified for the condensation of small, solid dust grains. Ion nucleation is unimportant, and exchange reactions with gas molecules are required. For carbon–rich stellar atmospheres, hydrocarbons act as intermediaries for converting acetylene gas into carbon particles. For oxygen–rich atmospheres, magnesium silicate grains form by surface nucleation. Sputtering and coalescence of grains is discussed. (auth)

17841 FORMATION AND FLOW OF DUST GRAINS IN COOL STELLAR ATMOSPHERES. Salpeter, E.E. (Physics Department and Center for Radiophysics and Space Research, Cornell University). Astrophys. J. 193: No. 3, 585-592 (1 Nov 1974).

Stars are considered which would have no mass loss in the absence of dust grains, but are sufficiently cool for grains to condense in the atmosphere. Stars of "high" luminosity lose gas and dust together at a copious rate; stars of "medium" luminosity lose mainly grains without gas, and the atmosphere may be denuded of grainforming material. Formulae are given for mass–flow rates and for final velocities. A servomechanism is suggested which may lead to fairly large ($\sim 0.1\ \mu$), scattering silicate grains. An instability is suggested for cool M giants and supergiants, which leads to a patchy distribution of surface temperature (grains in cool patches, high flux in warm patches). (auth)

17842 THE MASS OF THE DWARF NOVA EM CYGNI. Robinson, E.L. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 193: No. 1, 191-195 (1 Oct 1974).

The dwarf nova EM Cygni is a known eclipsing binary with a period of $0^d.29090942$. EM Cygni is also a double-lined spectroscopic binary. Its spectroscopic orbital elements are presented here. Previously published photometry of the system is used to determine the orbital inclination. The masses of the white dwarf and of the red star in EM Cyg are then found to be $0.70 \pm 0.18\ M_\odot$ and $0.90 \pm 0.17\ M_\odot$, respectively. If the red star is assumed to fill its Roche lobe, its radius is $(6.05 \pm 0.45) \times 10^{10}$ cm. This places the red star on the main sequence in the mass-radius diagram. (auth)

17843 THE EFFECTS OF DIFFERENCES IN COMPOSITION, EQUATION OF STATE, AND MIXING LENGTH UPON THE STRUCTURE OF WHITE-DWARF CONVECTION ZONES. Fontaine, G.; Van Horn, H.M. (Department of Physics and Astronomy and C. E. Kenneth Mees Observatory, University of Rochester, Rochester, New York); Böhm, K.; Grenfell, T.C. Astrophys. J. 193: No. 1, 205-211 (1 Oct 1974).

The effects of differences in composition, equation of state, and convective mixing length upon the structure of white-dwarf convection zones are studied by comparing six different helium-rich envelope model sequences with $g = 10^8$ cm s^{-2} and spanning the temperature range $6000° \geqslant T_e \geqslant 28{,}000°K$. In the hotter models, the structure of the convection zone is quite sensitive to the choice of mixing length, but the core temperature is not affected. Composition differences have moderate effects throughout the temperature range and are understandable in terms of their effects upon the atmospheric opacities. Equation-of-state differences also are discernible at all T_e, but are relatively unimportant above $T_e \simeq 7500°K$. At low temperatures, however, the equation-of-state effects dominate, and a calculation for the envelope of Van Maanen 2 ($T_e = 5500°K$, $g = 5.65 \times 10^7$ cm s^{-2}) yields a temperature at the base of the convection zone of $T_b = 1.12 \times 10^6 °K$, compared with the value $T_b = 2.15 \times 10^5 °K$ found previously for this temperature and surface gravity. In addition, the use of an improved equation of state appears to remove the previously reported sensitivity of T_b to changes in g and T_e. (auth)

17844 HYDROGEN AND HELIUM FEATURES IN MAGNETIC WHITE DWARFS. Kemic, S.B. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards and Department of Physics and Astrophysics, University of Colorado, Boulder). Astrophys. J. 193: No. 1, 213-216 (1 Oct 1974).

The formation of spectral features of hydrogen and helium atoms in white dwarfs having magnetic fields on the order of 10^6-10^8 gauss is investigated using a Milne-Eddington type schematic model atmosphere. Several examples are presented to illustrate the effects of varying the magnitude and orientation of the stellar dipole magnetic field. Results indicate that dipole fields on the order of 10^8 gauss are possible mechanisms for the production of DC-type white-dwarf spectra. While the spectrum of the magnetic white dwarf Grw +70°8247 cannot be identified as that of either hydrogen or helium in a field of less than 10^8 gauss, preliminary results indicate that a somewhat larger field may be responsible. (auth)

17845 ALIGNED ROTATING MAGNETOSPHERES. II. INCLUSION OF INERTIAL FORCES. Scharlemann, E.T. (Institute of Astronomy, Cambridge CB3 OHA, England). Astrophys. J. 193: No. 1, 217-223 (1 Oct 1974).

The solution to the equations governing the structure of an aligned, inertialess magnetosphere around a rapidly rotating object, as discussed by Scharlemann and Wagoner (Paper I), is treated as the lowest-order term in an expansion in the ratio of inertial to electromagnetic forces. An equation for the ion and electron accelerations in the magnetosphere is then obtained by including inertial forces to first order. The results of numerical integrations of this equation for several values of the free parameters, describing the solution are presented. For what is likely to be the most physically realistic case, large particle energies are not obtained until well outside the light cylinder. Large accelerations within the light cylinder are only found for the probably unrealistic case of nearly complete charge separation. (auth)

17846 PULSAR NEAR FIELDS. Parish, J.L. (Department of Physics, University of Illinois, Urbana). Astrophys. J. 193: No. 1, 225-229 (1 Oct 1974).

A pulsar model with magnetic and rotational axes perpendicular is considered. A single equation whose solution exactly and self-consistently solves Maxwell's equations and the equation of motion, $E = -v \times B$, is derived. Included in this equation is the effect of moderate currents along the B-lines. This equation is used to calculate the near fields around a neutron star with a dipole magnetic field on the surface. The first-order effects of rotation of the magnetosphere, but not the effects of current along the B-lines are considered in this calculation. (auth)

17847 OSCILLATOR STRENGTHS IN THE TiO ALPHA-BAND SYSTEM. Fairbairn, A.R.; Wolnik, S.J.; Berthel, R.O. (Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Bedford, Massachusetts). Astrophys. J. 193: No. 1, 273-277 (1 Oct 1974).

Absolute intensity measurements have been made of the most prominent TiO alpha bands appearing in shock-tube spectra. The results confirm and extend the King furnace relative-intensity measurements of Phillips. They are incompatible with the most recent and lowest reported dissociation energy of TiO (144 Kcal $mole^{-1}$, Balducci et al.) and favor either of the two earlier and higher values (157 or 168 Kcal/$mole^{-1}$). (auth)

17848 STELLAR REACTION RATES FOR PROTON CAPTURES ON ^{28}Si, ^{50}Cr, ^{54}Fe, ^{58}Ni, ^{60}Ni AND ^{61}Ni. Roughton, N.A. (Regis College, Denver, and Nuclear Physics Laboratory); Fritts, M.J.; Peterson, R.J.; Zaidins, C.S.; Hansen, C.J. Astrophys. J. 193: No. 1, 187-189 (1 Oct 1974).

This paper is the second in a series on the experimental determination of the stellar-proton-induced reaction rates, $N_A\langle\sigma v\rangle$, on middle-mass nuclei. We give the rates of capture on the ground states of ^{28}Si, ^{50}Cr, ^{54}Fe, ^{58}Ni, ^{60}Ni, and ^{61}Ni, determined from thick-target techniques and compare the measured rates with those derived theoretically from a statistical nuclear model. We also discuss a rapid target-transfer technique developed for measurements on short half-lived radioproducts such as from $^{28}Si(p,\gamma)\ ^{29}P(4.13-s\ \beta^+)$. We note the presence of strong analog resonances in the captures on ^{54}Fe and ^{50}Cr. (auth)

17849 WEAK INTERSTELLAR LINES IN THE VISIBLE SPECTRUM OF ZETA OPHIUCHI. Shulman, S. (E. O. Hulburt Center for Space Research, Naval Research Laboratory); Bortolot, V.J.; Thaddeus, P. Astrophys. J. 193: No. 1, 97-102 (1 Oct 1974).

Interstellar absorption lines in the spectrum of ζ Oph have been investigated using a synthesis technique to superpose 31 high-dispersion spectrograms in the wavelength region 3650-4340 Å. The minimum detectable equivalent width is approximately 0.25 mÅ. Lines which have been observed for the first time in the spectrum of this star are Ca I λ4226, Fe I λλ3720 and 3860, and K I λλ4044 and 4047. Using these data and assuming ionization equilibrium, a new evaluation of the electron density, hydrogen density, and elemental abundances is presented for the -15 km s^{-1} cloud. With the direct measurement of both the Ca I Ca II column densities, the relative abundance computations are shown to be insensitive to the choice of radiation field and kinetic temperature. (auth)

17850 STELLAR ENERGY DISTRIBUTIONS IN AN INFRARED CLUSTER IN ARA. Lockwood, G.W. (Lowell Observatory, Flagstaff, Arizona). Astrophys. J. 193: No. 1, 103-107 (1 Oct 1974).

Thirteen stars have been observed at near-infrared wavelengths ($0.71-1.05\ \mu$) in a heavily reddened cluster in Ara. Five stars appear to be M supergiants, while the remainder are OB stars. The mean interstellar absorption, A_v, is 12.8 mag for the OB stars and may be somewhat greater for the M stars. (auth)

17851 CONVECTIVE OVERSHOOT MIXING IN OLD OPEN CLUSTERS. Prather, M.J.; Demarque, P. (Yale University Observatory). Astrophys. J. 193: No. 1, 109-111 (1 Oct 1974).

A simplified form of overshoot mixing of convective cores in intermediate-mass stars ($0.90-1.40\mathfrak{M}_\odot$) is investigated in order to explain the anomalous gap structure of M67. The amount of overshooting is assumed to be proportional to the pressure scale height at the convective core boundary, and the entire region is completely mixed. Evolutionary tracks are computed for both standard and overshoot models, and isochrones are constructed. In the presence of overshoot mixing, the isochrones show (1) a higher gap, (2) a lower stellar number density immediately above the gap, and (3) the persistence of the gap to greater ages. (auth)

17852 SPECTROSCOPIC OBSERVATIONS OF O-TYPE STARS. V. THE HYDROGEN LINES AND λ4686 He II. Conti, P.S. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards, Boulder); Leep, E.M. Astrophys. J. 193: No. 1, 113-124 (1 Oct 1974).

We present data concerning the λ4686 He II and Hα lines, including selected profiles, in a number of O-type stars. We now find, in agreement with Walborn, that the emission-line behavior of λ4686 tends to correlate with luminosity. Both it and Hα come into emission if extended envelopes are present and it is this physical condition that is related to luminosity. Envelopes invariably appear in O-type stars if M_v is brighter than about -6. The observed emission strength of both lines and the extent of the envelope is relatively insensitive to luminosity. The scatter in the relation between these parameters is large and we feel one cannot predict M_v from the line strength more accurately than about ± 0.5 mag. We also call attention to a group of stars that we classify as Oe and Oef (the latter group identical to the Onfp designation of Walborn) in which characteristic "double" emission lines are observed in either the hydrogen lines, or in λ4686, respectively. We believe the double emission is the result of a combination of roughly central emission and central absorption in the line profile. These profiles can be produced by stars having envelopes with appreciable rotation. The Oe and Oef stars share the characteristic of having rapid rotation, and luminosity somewhat near the main sequence. They do not follow the luminosity—envelope relationship observed for the Of stars. We believe the Oe and Oef stars are a continuation of the Be phenomenon to the earliest spectral types, or at least the manifestation of rapid rotation affecting the atmosphere. (auth)

17853 AN EMPIRICAL LINE–BLANKETING STUDY OF Am STARS. Rydgren, A.E. (Steward Observatory, University of Arizona); Smith, M.A. Astrophys. J. 193: No. 1, 125-131 (1 Oct 1974).

Metallic line—blanketing coefficients have been measured over the wavelength range 3800 to 4700 A in a sample of 20 Am and normal A stars. An expression for the logarithmic iron abundance has been calibrated in terms of effective temperature and a mean line—blocking coefficient. This enables one to determine the atmospheric iron abundance in sharp—lined Am and A stars with an accuracy of better than ±0.1 dex, using only line—blocking measurements and a photometric effective temperature. (auth)

17854 A SEARCH FOR NEUTRAL IRON LINES IN a CENTAURI. Norris, J. (Yale University Observatory); Baschek, B. Astrophys. J. 193: No. 1, 133-134 (1 Oct 1974).

A search for neutral iron lines, which were reported by Underhill and Klinglesmith, in the helium spectrum variable a Cen has been carried out on spectra taken in 1968/69. No lines of Fe I have been found around the phase, 0.22, at which the lines were previously reported to be most prominent. (auth)

17855 SPECTRAL ENERGY DISTRIBUTIONS OF STANDARD STARS OF INTERMEDIATE BRIGHTNESS. I. Stone, R.P.S. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 193: No. 1, 135-137 (1 Oct 1974).

Spectral energy distributions for eight stars intended for use as spectrophotometric standards for large telescopes are presented. The monochromatic magnitudes of the stars range between 9 and 13, and the wavelength region covered extends from λ3200 to λ8370. (auth)

17856 PHYSICAL CHARACTERISTICS OF GIANT STARS IN THE ANOMALOUS GLOBULAR CLUSTER NGC 362. McClure, R.D.; Norris, J. (Yale University Observatory). Astrophys. J. 193: No. 1, 139-145 (1 Oct 1974).

Color indices on the DDO intermediate—band photometric system for giant stars in NGC 362 are found to be similar, in the mean, to those in the bright northern globular cluster M5. We conclude that the anomalous red—horizontal branch of NGC 362 cannot be explained by differences in heavy—element abundance. Small differences of the order of $\Delta Y=0.03$ in the helium abundance, or of a billion years in age, as pointed out by Rood, appear to be the most likely explanation. A spread, however, appears to exist in [Fe/H] among the individual stars on the giant branch, and this parameter correlates with a similar spread in CN strengths. (auth)

17857 A LOWER LIMIT ON THE ^{12}C/^{13}C RATIO IN ALPHA HERCULIS. Thompson, R.I. (Department of Astronomy and Steward Observatory, University of Arizona); Johnson, H.L. Astrophys. J. 193: No. 1, 147-150 (1 Oct 1974).

The second—overtone CO bands at 1.6 μ are used to determine a ^{12}C/^{13}C ratio for the M5 II star α Herculis. No firm detection of ^{13}CO bands are made in this region which allows a lower limit of 20 to be set on the ^{12}C/^{13}C ratio. Synthetic spectra from model atmospheres are used to perform the analysis. It is found that a rather low value of 2 km s^{-1} for the microturbulent velocity is needed to match the observed spectrum. (auth)

17858 ON THE ORIGIN AND EVOLUTION OF s—PROCESS ELEMENTS. Schramm, D.N. (Departments of Astronomy and Physics, University of Texas at Austin); Tinsley, B.M. Astrophys. J. 193: No. 1, 151-155 (1 Oct 1974).

The evolution of s—process abundances in the solar neighborhood is studied, using alternative stellar production sites and Galactic models. Production in either low—mass or medium—mass stars, as suggested in Ulrich's alternative models for FG Sge for example, can account for the solar—system abundances. Either case is consistent with independent limits on subsequent neutron exposure of nuclei produced in explosive oxygen and silicon burning and of r—process material. The cases could be distinguished by observations of the ratios of s—process to primary metal abundances in stars of different ages. The predictions are not strongly dependent on the model used for Galactic evolution. (auth)

17859 ON THE e—PROCESS: ITS COMPONENTS AND THEIR NEUTRON EXCESSES. Hainebach, K.L.; Clayton, D.D. (Rice University, Houston, Texas 77001); Arnett, W. D.; Woosley, S. E. Astrophys. J. 193: No. 1, 157-168 (1 Oct 1974).

We analyze the pattern of abundances within the iron—abundance peak, with special emphasis on the isotopes of Cr, Fe, and Ni, by comparing that pattern with those resulting from the quick cooling of matter initially in nuclear equilibrium (called e—process freeze—out). The freeze—out patterns are characterized by the extent to which the material is neutron rich. We calculate the superposition of zones of differing neutron enrichments that gives the best fit to a specified set of abundance ratios. The best one—zone fit to the isotopes of iron is the original e—process solution ($\eta=0.071$), but that solution seriously overproduces Cr and Ni isotopes. One—zone solutions without any serious overproductions ($\eta\simeq0.003$, called the low—η zone) eject ^{56,57}Fe as ^{56,57}Ni and produce ^{58}Ni instead of ^{58}Fe. Best two—zone fits add to the dominant low—η zone a high—η zone having adequate yields of ^{54}Cr, ^{58}Fe, and ^{62}Ni to account for their abundances. Three zones cannot substantially improve the fit to the total abundance pattern except in adding ^{60}Ni to the list of successfully synthesized species. No improvement can be obtained by using a superposition of more than three zones. We take these results to be telltale characteristics of the abundances themselves. The need for two zones seems sure. The dominance of the low—η zone speaks for a good future for nuclear γ—ray astronomy, whereas the need for a high—η zone should contain important constraints on the dynamics of collapse and ejection. A monotomic continuum of zones gives a poor fit, and the evidence for even a third is not compelling, because ^{60} Ni may be due instead to a low—η particle—rich freeze—out. (auth)

17860 ADVANCED EVOLUTION OF MASSIVE STARS. V. NEON BURNING. Arnett, W.D. (Department of Astronomy, University of Texas, Austin). Astrophys. J. 193: No. 1, 169-176 (1 Oct 1974).

Evolutionary sequences of massive helium stars (M_α = 4, 8, 16, and 32 $M_\odot$) are continued through neon burning and up to the ignition of ^{16}O + ^{16}O in the center. A preliminary analysis of nucleosynthesis and energy generation during neon burning is presented. A neon flash occurs for M_α = 4 and 8 $M_\odot$; it is probably a quasihydrostatic event. A strong tendency toward convergence in structure and evolution of the central regions is observed in the different models studied here. (auth)

17861 ASYMPTOTIC GIANT–BRANCH EVOLUTION OF A 0.6 $M_\odot$ STAR. Gingold, R.A. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, The Australian National University). Astrophys. J. 193: No. 1, 177-185 (1 Oct 1974).

The evolution of a double shell source 0.6 $M_\odot$ Population II star has been followed in detail through the asymptotic—branch phase into the region of the H—R diagram occupied by the nuclei of planetary nebula. No attempt has been made to suppress helium shell flashes. During the total of 14 relaxation oscillation cycles encountered, no convective mixing took plase between the helium shell and the hydrogen—rich layers. A small amount of the products of hydrogen burning was mixed to the surface by an extensive convective zone that developed shortly after major flash peaks. Toward the end of the asymptotic—branch evolution the star spent a considerable time in the region of the H—R diagram occupied by RV Tauri—type stars in globular clusters. (auth)

17862 DISTANCES TO EXTRAGALACTIC SUPERNOVAE. Kirshner, R.P. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington); Kwan, J. Astrophys. J. 193: No. 1, 27-36 (1 Oct 1974).

Distances to the Type II supernovae 19691 in NGC 1058 and SN 1970g in M101 are determined through Baade's method for variable stars. The photospheric temperatures are derived from spectrophotometric scans and from broad—band photometry. A model of line formation is used to relate the velocity of the material at the photosphere to observed line shapes in spectra and scans. These results are used to estimate a distance of 12±3 Mpc to NGC 1058 and 6±3 Mpc to M101. If the redshifts of these two nearby galaxies are proportional to distance, then $H_0=60\pm15$ km s^{-1} Mpc^{-1}. (auth)

17863 INFRARED PHOTOMETRY OF HIGH—LUMINOSITY SUPERGIANTS EARLIER THAN M AND THE INTERSTELLAR EXTINCTION LAW. Hackwell, J.A.; Gehrz, R.D. (Department of Physics and Astronomy, University of Wyoming). Astrophys. J. 194: No. 1, 49-55 (15 Nov 1974).

Photometric measurements from 2.3 to 23 μ are reported for luminous supergiants with spectral types earlier than M. Only HD 190323 (G0 Ia—Iab) showed hitherto unreported excess emission near 10 μ. We conclude that the previously reported excess infrared emission from luminous supergiants having intermediate spectral types is not a universal feature of these stars. A 4.9 μ absorption feature, possibly caused by the fundamental vibration band of CO or CN, appears abruptly in the supergiants near spectral type G5. An infrared reddening law has been derived from the supergiant photometry at 2.3, 3.6, 4.9, 8.7, 10 and 11.4 μ using the color difference method. An extrapolation of this reddening curve implies a ratio of total to selective extinction of $R = 3.40\pm0.15$. (auth)

17864 THE MANGANESE STARS. Wolff, S.C.; Wolff, R.J. (Institute for Astronomy, University of Hawaii). Astrophys. J. 194: No. 1, 65-75 (15 Nov 1974).

A spectrographic survey at 50 A mm^{-1} was undertaken to search for Mn stars. Observations in the spectral region λλ3440–3500, where the strongest lines of Mn II occur, were obtained for 194 stars of types B4–B9, and 24 were found to be Mn stars. The Hg line at λ3984 is definitely present in 20 of these stars. The Mn stars occupy the limited temperature range $0.33 < \theta_e < 0.48$, and in the range $0.36 < \theta_e < 0.42$, approximately 30 percent of the stars examined were found to be Mn stars. All the Mn stars have $V \sin i < 75$ km s^{-1}, and more than 70 percent have $V \sin i < 40$ km s^{-1}. The rate of incidence and the rotational velocity distribution of the Mn stars indicate that these stars constitute a substantial fraction of the slowly rotating stars in the temperature range in which they occur, a result that appears to be valid for open clusters as well as field stars. Two Mn stars are members of the Scorpio–Centaurus association, so the time scale for the formation of Mn stars appears to be less than 10^7 years. It is argued that the observed properties of the Mn stars can be accounted for most satisfactorily by the hypothesis that, because of the low rotation, the atmospheres of these objects are sufficiently stable for diffusion processes to be effective. (auth)

17865 ROCKET–ULTRAVIOLET SPECTRA OF KAPPA, LAMBDA, TAU, AND UPSILON SCORPII. Jenkins, E.B.; Morton, D.C.; York, D.G. (Princeton University Observatory). Astrophys. J. 194: No. 1, 77-85 (15 Nov 1974).

Rocket–ultraviolet spectra of τ Sco (B0 V), λ Sco (B1.5 V), κ Sco (B1.5 III), and ν Sco (B2 IV) are presented, covering ranges between 1160 and 1880 Å with resolutions of 0.8 and 2.2 Å. The close sequence of spectral and luminosity types permits a detailed comparison of how various spectral lines change with temperature and gravity. The advantages of specific features for a future ultraviolet classification system are discussed. In the main–sequence star τ Sco, the Si IV resonance lines show asymmetries that can be interpreted as outward mass motion with a velocity of up to 400 km s^{-1}. (auth)

17866 NEUTRAL HELIUM LINE STRENGTHS. VII. THE POPULATION II B STAR BARNARD 29 IN M13. Auer, L.H.; Norris, J. (Yale University Observatory). Astrophys. J. 194: No. 1, 87-93 (15 Nov 1974).

Using non–LTE model atmospheres and helium–line calculations the atmospheric parameters have been determined for the Population II star Barnard 29. We find $T_{eff} = 22{,}500^\circ \pm 1200^\circ K$, $\log g = 3.0 \pm 0.15$ (cgs) (on an unblanketed temperature scale) and $N(He)/N(H) = 0.115 \pm 0.03$. The Population I star, γ Pegasi, was analyzed with identical techniques. The two stars have the same He abundance within the accuracy of the determinations. An LTE analysis of the heavy elements shows that N and Si are enhanced relative to the metal abundance of the cluster giants. We consider possible causes of this result. (auth)

17867 THE SUBGIANT CH STARS. Bond, H.E. (Louisiana State University Observatory). Astrophys. J. 194: No. 1, 95-107 (15 Nov 1974).

A new class of peculiar stars has been discovered on objective–prism plates. These objects have G–type spectra with weak metallic lines but enhanced features of CH and the s–process elements, and most of these stars have high space velocities. Photometrically they show the high violet opacity seen in other carbon–rich stars of similar temperature. Several lines of evidence indicate visual absolute magnitudes near $M_v = +2$. These stars are similar in composition to, and much more common per unit volume of space than, the better–known CH stars. It is proposed that these objects acquire their unusual surface compositions in events that partially mix Population II red giants, and that later, as they evolve back up the red–giant branch, they become CH stars. These "subgiant CH stars" are probably present in several globular clusters. (auth)

17868 ADVANCED EVOLUTION IN GLOBULAR CLUSTERS. II. THE ULTRAVIOLET–BRIGHT STARS IN OMEGA CENTAURI. Norris, J. (Yale University Observatory). Astrophys. J. 194: No. 1, 109-123 (15 Nov 1974).

A radial–velocity survey of stars above the horizontal branch and to the left of the giant branch (the so–called UV–bright region) in the color–magnitude diagram of ω Centauri has established, or in two cases confirmed, the membership of nine stars in the region outside 9′ from cluster center. Low–dispersion spectra, together with photometry obtained using the Newell narrow–band system, the DDO intermediate–band system, and the UBV system, have been obtained and analyzed, leading to the following conclusions: i) The atmospheric abundances of the cool UV–bright star ROA 342 and the probable UV–bright star ROA 164 are the same as those of the cluster red giants. The observed value of $[Fe/H] = -1.4$ is in good agreement with that obtained by Dickens and Powell in their analysis of the UV–bright star ROA 24. There is no evidence for mixing of processed materials to the surface. ii) The two hot stars ROA 3596 (probably) and ROA 5701 (definitely) exhibit the lines of neutral helium in their spectra, in contradistinction to the results obtained by Rodgers for the hot supra–horizontal–branch stars ROA 1403 and 1853. Further work is necessary to ascertain if their helium abundances are the same as in Population I. iii) The UV–bright stars have a mass $\mathfrak{M}/\mathfrak{M}_\odot = 0.58 \pm 0.12$ (internal s.e.) similar to that obtained by Newell et al. for the horizontal–branch stars in this cluster. iv) No area in the UV–bright region is "forbidden." Comparison with theoretical results for advanced Population II evolution shows that the distribution of UV–bright stars in the $[\log L/L_\odot, \log T_{eff}]$–plane cannot be understood in terms of the evolution of stars whose progenitors had a unique total mass and helium core mass on the horizontal branch. Advanced evolution of stars which possessed a range in total mass or in core mass (or both) on the horizontal branch is the most probable explanation. It seems unlikely that the UV–bright stars in this cluster can be used to distinguish between the alternatives. v) The existence of several stars at a luminosity $\log (L/L_\odot) = 2.0–2.3$ indicates that the hot end of the horizontal branch in ω Cen has probably not yet been observed. If this is correct, a spread in envelope mass of at least 0.1 M is required on the horizontal branch, independent of the treatment of semiconvection in the horizontal–branch models. (auth)

17869 MASSES AND LUMINOSITIES OF POPULATION II CEPHEIDS. Böhm–Vitense, E.; Szkody, P.; Wallerstein, G. (Astronomy Department, University of Washington, Seattle); Iben, I. Jr. Astrophys. J. 194: No. 1, 125-135 (15 Nov 1974).

Mean luminosities, effective temperatures, and radii of 11 Population II Cepheids are derived from three color photometry and, in some cases, radial velocities. From a comparison of the observed and the theoretical period–radius relation masses of $0.55 \pm 0.05\ \mathfrak{M}_\odot$ – are derived for all Population II Cepheids except the variables No. 1 and 2 in $\mathfrak{M}$ 13, which appear to be less massive and possibly helium–rich. The period–luminosity relation is also discussed. (auth)

17870 CALCIUM II K EMISSION IN RT AURIGAE. Hollars, D.R. (New Mexico State University). Astrophys. J. 194: No. 1, 137-139 (15 Nov 1974).

Spectrographic observations of Ca II emission in the classical Cepheid RT Aurigae (period = $3^{d}73$) are presented. Although Ca II emission occurs on the rising branch of the light curve in many Cepheids, it has not previously been observed in stars with periods under 4 days. (auth)

17871 RAPID LIGHT VARIATIONS OF YZ CANCRI: An UNUSUAL SS CYGNI STAR. Moffett, T.J.; Barnes, T.G. III (McDonald Observatory and Department of Astronomy, The University of Texas at Austin). Astrophys. J. 194: No. 1, 141-146 (15 Nov 1974).

High time–resolution photometry of the SS Cygni variable YZ Cancri is reported. A thorough search for photometric evidence of binary effects is negative. In the light of previous spectroscopy, this is interpreted as evidence for a small inclination of the orbit to the plane of the sky. Incoherent light variation ("flickering") is observed down to a time scale of 20 s. The extraordinary amplitude of the flickering, 0.75 mag peak–to–peak, demands that the hot spot dominate the light from the system, which probably indicates a high rate of mass transfer. There is marginal evidence for coherent oscillation with a period of 27 s and amplitude of 0.0018 mag during the decline from maximum light (outburst). (auth)

17872 ON THE PASSAGE OF RADIATION THROUGH INHOMOGENEOUS, MOVING MEDIA. VIII. RAY PATHS AND FLUXES IN A PLANE DIFFERENTIALLY SHEARED MEDIUM. Lee, M.A. (Enrico Fermi Institute, University of Chicago). Astrophys. J. 194: No. 1, 165-175 (15 Nov 1974).

We give a detailed discussion of the group–velocity ray paths in a plane differentially sheared medium with constant index of refraction as measured by a local inertial observer. For a given velocity profile the numerical ray paths are presented graphically for several representative cases. Assuming that the medium has a volume emissivity and that a given flux of radiation is incident at the base of the medium, the flux of radiation leaving the slab as a function of exit angle is calculated and presented in the same representative cases. Peaks and discontinuities in the flux generally appear at given exit angles, but their locations and the half–widths of the peaks depend sensitively on the index of refraction. (auth)

17873 ON THE PASSAGE OF RADIATION THROUGH INHOMOGENEOUS MOVING MEDIA. IX. AN INITIAL VALUE PROBLEM AND AN OSCILLATORY "STEADY–STATE" PROBLEM. Lerche, I. (Enrico Fermi Institute and Department of Physics, University of Chicago). Astrophys. J. 194: No. 1, 177-186 (15 Nov 1974).

In this paper we demonstrate how the Poynting flux is distributed in both space and time in the cases where the source of the electromagnetic field is either an impulse current sheet or an oscillatory current sheet, both being embedded in a differentially shearing medium. We compare the results obtained with those obtained under a time averaging process such as that given in Paper VII of this series. The results are of interest in connection with the problem of transport of radiation through the magnetospheres of pulsars—a spatial regime of particular interest being the neighborhood of the speed–of–light circle where large differential shear must obtain. (auth)

17874 FOUR–STOKES–PARAMETER RADIOFREQUENCY POLARIMETRY OF A FLARE FROM AD LEONIS. Spangler, S.R.; Rankin, J.M.; Shawhan, S.D. (Department of Physics and Astronomy, University of Iowa, Iowa City). Astrophys. J. Lett. 194: No. 1, L43-L46 (15 Nov 1974).

Observations of the four Stokes parameters of a 430–MHz flare from the UV Ceti–type star AD Leo are presented. The maximum amplitude of the event was 0.52 flux units, and the durations at one–half and one–tenth maximum were 12 and 40 s, respectively. The degree of circular polarization at maximum intensity was approximately 56 percent and was later observed to be as high as 92 percent. Linear polarization was also observed at a level of about 21 percent at flare maximum which allowed an upper limit of 440 radians m^2 to be placed on the rotation measure. (auth)

17875 DISCOVERY OF A MAGNETIC DA WHITE DWARF. Angel, J.R.P.; Carswell, R.F.; Strittmatter, P. (Steward Observatory, University of Arizona); Beaver, E.A.; Harms, R. Astrophys. J. Lett. 194: No. 1, L47-L50 (15 Nov 1974).

The spectrum of the white dwarf suspect, GD 90, is shown to contain broad Balmer lines with resolved Zeeman structure. All the observed features correspond to the calculated spectrum of hydrogen at $5\pm0.5\times10^6$ gauss. A region of ~20 percent of the observed stellar disk must be subject to a reasonably uniform field of this strength. The σ components of the Zeeman patterns in $H\beta$ and $H\gamma$ are found to be circularly polarized, indicating the field has a component directed along the line of sight. There is evidence for an additional stronger and less homogeneous field, as would be expected if the dominant 5×10^6 gauss region were at the equator of a dipolar field. (auth)

17876 SPECTROPHOTOMETRY OF MAGNETIC DEGENERATE STARS. Greenstein, J.L. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. Lett. 194: No. 1, L51-L55 (15 Nov 1974).

Absorption features seen in multichannel scans of the degenerate stars presently know to be circularly polarized, or to have magnetic fields are described. They seem not to vary with time, are largely unidentified, and are located near minima or maxima in the curve of dependence on wavelength of polarization. A classification nomenclature is proposed. GD 90 is a DAP with enhanced, partially Zeeman–resolved Balmer lines; G99–37 is carbon–rich; other polarized stars are nearly featureless, DCP or DXP. A 2400 Å wide absorption exists in G240–72 and one over 600 Å wide in G227–35. Fields well over 10^6 and probably over 10^7 gauss are required. A table contains observed parameters of nine stars; a much larger fraction than normal for white dwarfs are quite cool. A possibility is that convection amplifies and brings to the surface magnetic fields. (auth)

17877 INTERSTELLAR LINES IN STARS AT HIGH GALACTIC LATITUDES. Cohen, J.G. (Kitt Peak National Observatory, Tucson). Astrophys. J. 194: No. 1, 37-40 (15 Nov 1974).

We have measured the velocity and equivalent widths of the optical interstellar lines in a group of southern B stars at high galactic latitudes, as well as additional data for the stars previously discussed by Münch and Zirin. The main peculiarities of the interstellar matter far above the plane seem to be an increase in the ratio of the column density of Ca II to that of Na I and, less certainly, an excess of Ca II relative to H I. The gas–to–dust ratio indicates that some of the hydrogen at high galactic latitutdes may be ionized. (auth)

17878 OLD PLANETARY NEBULAE AND THE RELATION BETWEEN SIZE AND EXPANSION VELOCITY. Bohuski, T.J. (Washburn Observatory, University of Wisconsin–Madison); Smith, M.G. Astrophys. J. 193: No. 1, 197-203 (1 Oct 1974).

A plot of data on expansion velocity of [O III] ions as a function of outer radius for relatively small, high–surface–brightness planetary nebulae is consistent with a linear relation between the two parameters. For medium– and high–excitation planetaries, this relation also holds for hydrogen ions and deviates significantly from the relation of Mathews (derived for idealized spherically symmetric nebulae). Extrapolation of this empirical relation to larger radii would require very large expansion velocities for the old planetary nebulae and would thereby raise questions regarding the energy needed to drive and maintain the expansion. Observations of emission–line profiles from a few large, faint, and presumably old planetary nebulae were made in order to test the validity of such an extrapolation. The new data show that at least some of the older planetary nebulae have unusually low intrinsic velocities of expansion. These results suggest that although adjustments to the assumed time–dependent dynamical pressure may be required in Mathews's models, these models can account, at least qualitatively, for the general expansion properties of the planetary nebulae. (auth)

17879 Fe I LINE FORMATION IN SOLAR-TYPE GIANTS AND DWARFS. Lites, B. W.; Crowley, C. R. (Observatory, Geneva). Astron. Astrophys.; 31: No. 4, 361-369(Apr 1974).

The formation of Fe I lines is investigated in stellar models of solar T_{eff} but surface gravities ranging from log g = 4 to log g = 2. The results of these kinetic equilibrium computations demonstrate that the departures from LTE in the Fe I lines generally cause only small differences from equivalent widths computed under the LTE assumption. Thus one does not expect large errors in iron abundance determinations to arise in stars of these types from the neglect of departures from LTE. The Fe I line formation in stars of extremely low metal abundances indicates that departures from LTE in the Fe I–Fe II ionization balance could cause an iron abundance based upon the Saha equilibrium to underestimate the true abundance by a maximum of about 40%. This study provides no evidence that departures from LTE in Fe I lines could account for the increase in measured microturbulence from solar-type dwarf to supergiant stars as determined by curve-of-growth studies. However, moderate strength Fe I lines may be strongly affected by damping, and the failure to recognize this may lead to overestimates in curve-of-growth microturbulences. (auth)

17880 ENERGY REQUIREMENTS OF MICROTURBULENCE. Hearn, A. G. (Univ., Heidelberg). Astron. Astrophys.; 31: No. 4, 415-418(Apr 1974).

The flux of energy required to maintain microturbulence against viscous dissipation has been calculated assuming that it results from a progressive longitudinal wave. This has been applied to the Sun, a metallic line star 63 Tauri with a large microturbulent velocity and a B type star. In these stars the flux of energy required is at least 100 times greater than the calculated acoustic flux generated by the convection zone. For 63 Tauri the flux required is 10% of the total radiative flux, so that the energy requirements are severe but not impossible. In B type stars the flux required is only 10^{-3} of the radiative flux, but such stars do not have significant convection zones and there is no mechanism to explain microturbulence. (auth)

17881 STELLAR BIRTHRATES AND AGE DISTRIBUTIONS. Tinsley, B. M. (Univ. of Texas, Dallas). Astron. Astrophys.; 31: No. 4, 463-465(Apr 1974).

A general relationship is derived between the age distribution of A–F stars and the time-dependence of their birthrate. Depletion of these stars by death, which is relatively more severe in older generations, means that their present age distribution is not directly proportional to the birthrate. Two recently derived age distributions, each for several hundred nearby evolving stars, are shown to be consistent with a birthrate that has decreased over the past 7 billion years, with e-folding time about 5 billion years. (auth)

17882 THEORETICAL ASPECTS OF LIGHT VARIATIONS OF MAGNETIC STARS. Rakosch, K. D.; Sexl, R.; Weiss, W. W. (Univ. of Vienna). Astron. Astrophys.; 31: No. 4, 441-446(Apr 1974).

It is shown by the example of α^2CVn that it is possible to calculate the amplitude of light variations of magnetic stars over a large spectral range (1500 Å to 6000 Å), if one assumes different integral effective values of gravity and temperature for both magnetic poles and the magnetic equator. The influence of the magnetic field on effective gravity is shown to be large. A van Allen belt-type extension of the stellar photosphere along the magnetic equator is suggested to be the cause of the observed light variations. (auth)

17883 DIFFUSION, He-WEAK STARS, AND ^{3}He IN 3 CEN A. Vauclair, S. (Observatory, Meudon, France); Michaud, G.; Charland, Y. Astron. Astrophys.; 31: No. 4, 381-390(Apr 1974).

Microscopic diffusion below the helium convection zone in A–B type stars leads to an underabundance of helium by a factor of thirty or so and to a relative overabundance of ^{3}He. It also predicts that the helium weak stars should be much more numerous than the stars where ^{3}He/^{4}He > 1. Saturation of the radiation field is shown, in detailed time-dependent calculations of diffusion in the envelope, to put a limit on the helium that can be supported by the radiation field to at most 1% by number, of the hydrogen abundance. Lines of helium cannot support nearly that much. The most important process is the photoionization of He II. Because it is lighter than ^{4}He, ^{3}He slowly replaces ^{4}He in the outer envelope and in the atmosphere. ^{3}He migrates from the inner envelope. The migration time slows down the process. (auth)

17884 STATIC CRITERIA FOR STABILITY OF ARBITRARILY ROTATING STARS. Bisnovatyi-Kogan, G. S.; Blinnikov, S. I. (Inst. of Applied Mathematics, Moscow). Astron. Astrophys.; 31: No. 4, 391-404(Apr 1974).

Static criteria for the hydrodynamical stability of stars are discussed. New formulations of static criteria, which are suitable for studying the stability of nonrotating and rapidly rotating isentropic stars are proposed. The practical use of the method is illustrated by numerical examples for some stellar models. The computations were carried out by an exact selfconsistent method. The importance of the correct treatment of the degeneracy of the neutral fundamental mode with convective modes of oscillation in the isentropic star is pointed out. The possibilities of generalization to the case of general relativity and frozen-in toroidal magnetic fields are also discussed together with the difficulties thereby introduced. (auth)

17885 INTEGRAL IMAGE PRODUCED BY GRAVITATIONAL-LENS EFFECT. Wayte, R. C. (Imperial Coll. of Science and Tech., London). Mon. Notic. Roy. Astron. Soc.; 169: No. 1, 1-6 (Oct 1974).

It is shown that apart from the generally mentioned amplified image of a star or galaxy produced by the gravitational-lens effect of a black hole, there is also present an integral image due to all the stars and galaxies in the sky. This image is present continuously in time, and is not critically dependent on the probability of axial alignment of the observer, black hole, and object star, or galaxy. (auth)

17886 INFLUENCE OF THE HYDROGEN-MOLECULE ON THE ADIABATIC GRADIENT. Wehrse, R. (Univ., Kiel). Astron. Astrophys.; 35: No. 1, 157-159(Sep 1974).

For use in the construction of model atmospheres for cool and high gravity stars the adiabatic temperature gradient ∇_{ad} is given in the range $3.55 \leqq \log T \leqq 4.05$ and $3.0 \leqq \log P \leqq 9.5$. Solar composition is assumed. In the calculation of the entropy, contributions of H, H^+, e, H_2, and He are taken into account. The inclusion of hydrogen molecules reduces ∇_{ad} drastically for $\log T < 3.75 + 0.075 (\log P - 5)$. (auth)

17887 BF AUR: A CONTACT MASSIVE SYSTEM DISPROVING FISSION. Mammano, A.; Margoni, R.; Stagni, R. (Univ., Padua). Astron. Astrophys.; 35: No. 1, 143-147(Sep 1974).

The spectroscopic orbit of the eclipsing binary star BF Aur obtained at Asiago, combined with photometric elements, yields: $m_1 = m_2 = 5_\odot$, $R_1 = R_2 = 5_\odot$, separation $13_\odot$, both spectra are B 5 V. Each component is contacting its Roche lobe, contrary to a prediction of Roxburgh's fission theory (1965), which sets a limit of $4m_\odot$ to the mass of contact systems. One would ask whether the components or their photospheres can coalesce when they simultaneously evolve from the main sequence. This could remove one of Kopal's objections to the binary evolution theory. (auth)

17888 ORBITAL PERIOD OF ORI A, THE SUGGESTED OPTICAL COUNTERPART OF THE X-RAY SOURCE 2 U 0525-06. Margoni, R. (Univ., Padua); Pinto, G.; Barbon, R.; Bernacca, P. L. Astron. Astrophys.; 35: No. 1, 149-150(Sep 1974).

A new orbital period for θ^2 Ori A is derived from new and old radial velocities covering the period 1903-1973. The presence of a possible change in the period is also investigated. (auth)

17889 MATRIX METHOD OF DERIVING STELLAR SPACE DENSITIES. Dolan, J. F. (Case Western Reserve Univ., Cleveland). Astron. Astrophys.; 35: No. 1, 105-114(Sep 1974).

The methods employed in the direct reduction of astronomical x-ray spectra (Dolan, 1972) are applicable to the problem of determining the space distribution of stars of known spectral class grouped according to apparent magnitude. The method is straightforward, requires little reduction time, and can be carried out by hand. The procedure provides an explicit measure of the uncertainty in the resultant stellar space densities; this measure is derived directly from the natural uncertainty in the observed number of stars within each magnitude range. The method may also be used to derive the absorption in the field of view if the distribution of stellar space density with distance is known. Typical applications of the method are exhibited. (auth)

17890 POSSIBLE GENERALIZATION OF THE WILSON–BAPPU EFFECT. Neckel, H. (Observatory, Hamburg). Astron. Astrophys.; 35: No. 1, 99-104(Sep 1974).

A dependence of the Ca II K line emission with W_0 on gravity g and effective temperature T_e as suggested by Reimers (1973) for late type stars would imply the following facts: 1. Main sequence stars and stars with horizontal evolutionary tracks in the $M_{bol} - \log T_e$ diagram obey strictly a linear relation between $\log W_0$ and visual absolute magnitude M_v ("main sequence relation"). 2. Stars with an upward component (ΔM_{bol}) of the evolutionary track fall below the main sequence relation by an amount which is 0.33 ΔM_{bol} and which corresponds to the systematic deviations to be found in any two-dimensional spectral classification. 3. In the $M_v - \log W_0$ diagram the evolutionary tracks of stars, which deviate from the mass–luminosity relation, are straight lines which are slightly tilted against the main sequence relation. Stars with different masses move along parallel lines. 4. Metal deficiency in old stars with an essentially upward evolution could tend to preserve the main sequence relation. 5. M_v and $\log W_0$ fix essentially mass and evolutionary status (namely ΔM_{bol}) of single stars, if their metal content is normal or metal deficiency can be accounted for. (auth)

17891 THEORETICAL EVOLUTION OF MASSIVE POP. I AND POP. II STARS. Chiosi, C.; Nasi, E. (Univ., Padua). Astron. Astrophys.; 35: No. 1, 81-92(Sep 1974).

Evolutionary models of a 20 $M_\odot$ star with Pop. II initial chemical composition (given by the mass abundances $X = .700$ and $Z = .001$) are computed from the main sequence to the post core He-exhaustion stages. Semiconvective instability is treated according to the Schwarzschild–Härm criterion $\nabla_R = \nabla_a$. The results are compared to those for Pop. I stars having the same mass and initial hydrogen but different metal contents. The theoretical frequency distribution of massive stars ($M \gtrsim 10\ M_\odot$) in the different parts of the HR diagram is found to depend sensibly on the initial chemical composition parameters X and Z. By comparing the theoretical frequency distribution with the experimental one for supergiant stars in the Galaxy and the Large and Small Magellanic Clouds, an attempt is made at determining the average X and Z parameters for the three galaxies. The metal content Z is found to be greater in our Galaxy than in the Small Magellanic Cloud; this result agrees quite well with several indications derived from the analysis of period–color diagrams of Cepheids in the three galaxies. (auth)

17892 PHOTOMETRY AND STRUCTURE OF THE PLANETARY NEBULA NGC 6720 IN LYRA. Proisy, P. E. (Observatory, Lyon). Astron. Astrophys.; 35: No. 1, 71-76(Sep 1974). (In French).

A photometric study of the nebula was made on direct monochromatic photographs secured with the 80 cm reflector of the Observatory of Haute Provence, in H_α+ [N II], [O III], He II, [Ne III]. A systematic comparison of the dimensions of these images is made: H_α+ [N II] and [Ne III] yield the largest ones and [O III] the smallest one; the difference of dimension in every case does not exceed 4% of the mean value observed with He II. The variations of the brightness on the surface of the nebula cannot be ascribed to a structure similar to a flat disk, as has often been asserted, but to a toroidal barrel-shaped mass of gas, the axis of which lies in the plane made by the major axis of the observed outline of the nebula and the line of sight, at an angle of 30 to 50° to that line. An angle of about 90° would lead to a somewhat rectangular outline, an angle of about 0° to an approximately circular one, such as is observed in many cases. The structure of NGC 6720 is, therefore, very typical. (auth)

17893 FINAL EVOLUTION OF DIFFERENTIALLY ROTATING DEGENERATE CONFIGURATIONS. Koester, D. (Univ., Kiel). Astron. Astrophys.; 35: No. 1, 77-80(Sep 1974).

Simple models in a spherically symmetric approximation are used to study the final evolution of differentially rotating degenerate configurations in the course of crystallization. Assuming the growth in time of a crystallized core in uniform rotation by redistribution of angular momentum within the core, and neglecting transport of angular momentum in the outer noncrystallized layers. It is demonstrated that in a rather limited region of the angular momentum–mass diagram an increase of central density leads to catastrophic evolution (supernova), whereas in most cases crystallization is terminated by rotational mass loss and formation of a stable, uniformly rotating white dwarf. (auth)

17894 HD 52942, A NEW EARLY-TYPE ECLIPSING BINARY WITH A DOUBLE-LINE SPECTRUM. Moffat, A. F. J.; Vogt, N. (Univ., Bochum, Ger.). Astron. Astrophys.; 30: No. 3, 381-384 (Feb 1974).

HD 52942 is a close detached binary located in a reflection nebula in the CMa OB 1 association. The components are nearly equal (B 2.5 IV–V) and undergo partial eclipses with a period of 1.27306 d. (auth)

17895 SPECTRA OF Si II AND Si III IN ζ DRACONIS. Pagel, B. E. J. (Royal Greenwich Observatory, Herstmonceux Castle, Eng.). Astron. Astrophys.; 30: No. 3, 471-473(Feb 1974).

On the basis of equivalent widths given by Underhill (1973a) for the B 6 III star ζ Dra, it is shown that the Si II/Si III ionization equilibrium is in accordance with simple-minded LTE estimates, but that two lines attributed to the doubly excited multiplet 13 of Si III are anomalously strong and apparently misidentified. (auth)

17896 MULTIPLE SOLUTIONS OF THE EQUATIONS OF STELLAR STRUCTURE. III. Secular Stability of E Models. Lauterborn, D.; Siquig, R. A. (Univ. of Colorado, Boulder). Astron. Astrophys.; 30: No. 3, 385-389(Feb 1974).

It is shown that the secular behavior of stellar models with core helium and shell hydrogen burning can be inferred from their envelope (part where $X > 0$) structure only; the reaction of the core can be simulated with sufficient accuracy by appropriate boundary conditions at the bottom of the envelope. A large number of E model sequences are then tested for secular stability; it is found that in all cases the intermediate (Bereich B) solution is secularly unstable. (auth)

17897 RADIUS AND TEMPERATURE OF MIRA. Koester, D. (Univ., Kiel). Astron. Astrophys.; 30: No. 3, 391-394(Feb 1974).

The combination of radial velocity and near-infrared photoelectric observations of Mira supports the explanation of the variations in terms of volume pulsation and leads to the derivation of a mean radius and a tentative temperature scale. (auth)

17898 STATISTICS OF THE β CEPHEI STARS. Percy, J. R. (Univ. of Toronto). Astron. Astrophys.; 30: No. 3, 465-466(Feb 1974).

Information on the variability of B 1–B 2 star has been gathered from the literature. Of the 42 B 1–B 2 stars within 200 pc of the Sun, at least 8, or 19%, are β Cephei stars. This figure may be (1) too low because of incomplete information about variability of B 1–B 2 stars and (2) too high because the sample of stars studied contains an abnormally high proportion of giants. Most likely, these two effects will balance and the true frequency of β Cephei stars is about 20%, with a statistical uncertainty of a factor of 2. (auth)

17899 DYNAMICAL METHOD TO ESTIMATE THE RELATIVE MASSES OF THE STARS IN SPHERICAL CLUSTERS. Varanov, A. S. Vestn. Leningrad. Univ., Mat., Mekh., Astron.; No. 3, 122-130(Jul 1974). (In Russian).

A method to estimate the relative masses of the stars in spherical clusters is suggested. The method is based on the comparison of the numerical-experimental statistical mean distances from the stars of different mass to the center of the cluster with observational values. The method is applied to three globular and two open clusters. The results show a close correlation between the masses of the stars and their luminosities in all cases under consideration. (auth)

17900 DYNAMICS OF THE ENVELOPES OF Be-STARS IN THE TOROIDAL MAGNETIC FIELD AND STABILITY OF THE ENVELOPE'S MOTION. Morozov, V. N. Vestn. Leningrad. Univ., Mat., Mekh., Astron.; No. 3, 137-141(Jul 1974). (In Russian).

The features of stationary flow of plasma which models the envelope of Be-stars, in the toroidal magnetic field are investigated. The stability of plasma moving in magnetic field with geometry $H = (H_r, H_\varphi)$, where H_r is the radial component of field, H_φ is its azimuth component is considered. The instability of envelope, having the strong toroidal magnetic field ($|H_\varphi| \gg |H_r|$) is proved. (auth)

17901 SPECTROPHOTOMETRIC ANALYSIS OF THE PROMINENCE OF SEPTEMBER 30, 1971. Zakharova, G. A. Vestn. Leningrad. Univ., Mat., Mekh., Astron.; No. 1, 131-138(Jan 1974). (In Russian).

The profiles of $H_\alpha - H_\delta$ lines of hydrogen, D_3 $\lambda\lambda$ 4471, 3889 of helium and of H and K lines of CAII at several heights above the limb are found for the prominence of September 30, 1971. The main physical parameters (T_{kin}, v_t the numbers of atoms along the line of sight etc.) are determined. It is shown that the prominence is a rather homogeneous formation. The excitation of hydrogen is due to electronic impacts. (auth)

17902 INTERACTION BETWEEN NOVA SHELL AND CIRCUMSTELLAR ENVELOPE. Fedorova, O. V. Vestn. Leningrad. Univ., Mat., Mekh., Astron.; No. 1, 156-160(Jan 1974). (In Russian).

The motion of shock wave arising in interaction between an expanding nova shell and circumstellar envelope is briefly considered. It is found that the form of the shell is only slightly influenced by the shock. The possible causes of observed stratification of radiation in the shell of N Her 1934 are discussed. High optical density of the equatorial part of a shell for the frequencies beyond the ionization limit of O^+ is most likely the main cause of stratification. (auth)

17903 EVOLUTION OF A MASSIVE PROTOSTAR. Appenzeller, I.; Tscharnuter, W. (Univ., Goettingen, Ger.). Astron. Astrophys.; 30: No. 3, 423-430(Feb 1974).

The hydrodynamic evolution of a massive protostar has been calculated starting from a homogeneous gas and dust cloud of 60 $M_\odot$ and an initial density of 10^{-19} g cm^{-3}. Initially the collapsing gas cloud evolved similar to protostar models of lower mass. About 3.6×10^5 years after the beginning of the collapse a small hydrostatic core was formed. About 2×10^4 years later hydrogen burning started in the center of the hydrostatic core. After another 2.5×10^4 years the collapse of the envelope was stopped and reversed by the heat flow from the interior and the entire envelope was blown off, leaving behind an almost normal main-sequence star of about 17 $M_\odot$. During most of the core's evolution the central region of the protostar would have looked like a cool but luminous infrared point source to an outside observer. (auth)

17904 UNIQUENESS OF THE SOLUTIONS FOR STELLAR EVOLUTION. Kaehler, H.; Weigert, A. (Hamburger Sternwarte, Ger.). Astron. Astrophys.; 30: No. 3, 431-439(Feb 1974).

The uniqueness of stellar evolution is investigated for the following usual approximations: (1) evolution of equilibrium models, (2) evolution on "thermal" time scales. For the second case, the concept of linear series is extended to nonequilibrium models, and nonstatic atmospheres have to be discussed. The connection between uniqueness and the stellar stability problem is also discussed. (auth)

17905 DETECTABILITY AND NATURE OF CNO ANOMALIES IN EARLY-TYPE MAIN-SEQUENCE STARS. Baschek, B.; Scholz, M. (Univ., Heidelberg). Astron. Astrophys.; 30: No. 3, 395-402 (Feb 1974).

Using model atmosphere techniques, selected spectral features in near-main-sequence stars were calculated in the range O 9–B 5 for eight different element mixtures which were chosen to characterize the anomalous CNO line strengths discovered by Walborn. CNO abundance anomalies can be detected at classification dispersion through anomalous line strengths or through inconsistencies from different classification criteria. A comparison of the results with the predictions by Paczyński (1973) does not give much support to the hypothesis that meridional circulation causes the N type anomaly in hot main-sequence stars. (auth)

17906 CIRCUMSTELLAR SHELLS OF PROTOSTELLAR ORIGIN. Berruyer, N. (Observatoire de Nice). Astron. Astrophys.; 30: No. 3, 403-409(Feb 1974).

Numerical models of protostars indicate that the time scale for contraction of the envelope is greater than the contraction time of the core. For massive objects, the envelope is still present when the main sequence is reached and still contains dust grains. The development of the H(II) region is calculated taking into account the protostellar origin of the circumstellar medium. The results obtained are rather different from those obtained on adopting classical hypotheses. The H(II) regions may be very small and may tentatively be identified with the superdense H(II) regions which have been observed. The importance of the initial conditions in the protostellar medium is also discussed. (auth)

17907 COLLAPSING MOLECULAR CLOUDS? Loren, R.B.; Peters, W.L.; Vanden Bout, P.A. (Electrical Engineering Research Laboratory and Department of Astronomy, University of Texas at Austin). Astrophys. J. Lett. 194: No. 2, L103-L107 (1 Dec 1974).

Observations of CO emission have been made of the molecular clouds surrounding the emission–line stars R CrA and LkHα 198 and a cloud in the reflection nebulosity association Mon R2. In all three clouds the $^{12}C^{16}O$ J=1–0 line width shows systematic variations with position in the cloud, the widest lines occurring at the positions of the central stars in the R CrA and LkHα 198 clouds and at the position of peak line intensity in the Mon R2 cloud. For the clouds associated with the emission–line stars the $^{13}C^{16}O$ lines are narrower than the $^{12}C^{16}O$ lines and show less pronouned line width variation. In the Mon R2 cloud the $^{13}C^{16}O$ line width variations are easily seen. The line width behavior cannot be explained in detail by any of the models currently proposed for molecular clouds. If the clouds are indeed collapsing, the collapse velocity is inversely proportional to some power of the distance from the center of collapse. (auth)

17908 A STRONG WATER MASER ASSOCIATED WITH A HERBIG–HARO OBJECT. Dickinson, D.F. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory); Kojoian, G.; Strom, S.E. Astrophys. J. Lett. 194: No. 2, L93-L95 (1 Dec 1974).

A strong water emission line has been observed at 22 GHz in the direction of NGC 1333. The maser is near an infrared source associated with a group of Herbig–Haro objects. A search of 16 other H–H objects for H_2O maser emission yielded negative results. (auth)

17909 BD+37°1977: A VERY HOT SUBDWARF. Wolff, S.C.; Pilachowski, C.A.; Wolstencroft, R.D. (Institute for Astronomy, University of Hawaii). Astrophys. J. Lett. 194: No. 2, L83-L85 (1 Dec 1974).

BD+37°1977, one of the hottest objects identified by observations with the ESRO TD 1A satellite, is shown to be a subluminous O–type star. (auth)

17910 THE NEARBY DOUBLE STAR G208–44/45. Harrington, R.S. (U. S. Naval Observatory, Washington); Dahn, C.C.; Guetter, H.H. Astrophys. J. Lett. 194: No. 2, L87-L87 (1 Dec 1974).

The faint double star G208–44/45, at a distance of only 4.7 pc, consists of two main-sequence red dwarfs of absolute magnitude 15.0 and 15.6 and masses of approximately 0.1 $M_{\odot}$. (auth)

17911 THE $^{12}C/^{13}C$ RATIO IN THE ATMOSPHERE OF THE K2 SUPERGIANT EPSILON PEGASI. Lambert, D.L.; Tomkin, J. (McDonald Observatory and Department of Astronomy, University of Texas at Austin). Astrophys. J. Lett. 194: No. 2, L89-L91 (1 Dec 1974).

The $^{12}C/^{13}C$ abundance ratio in the atmosphere of the K2 Ib supergiant ϵ Peg is derived from high−resolution photo−electric spectral scans of lines from the CN red system. The high ^{13}C abundance, $^{12}C/^{13}C=5.1\pm0.5$, and Greene's demonstration that the atmosphere is rich in N and deficient in C and O, are consistent with the hypothesis that the star has undergone extensive internal mixing. (auth)

17912 CNO TRI−CYCLING AS AN ^{17}O ENRICHMENT MECHANISM. Dearborn, D. (Department of Astronomy, University of Texas at Austin); Schramm, D.N. Astrophys. J. Lett. 194: No. 2, L67-L70 (1 Dec 1974).

The recent nuclear physics experiments by Rolfs and Rodney, which show that the $^{17}O(p, \alpha)^{14}N$ reaction may be much slower than previously assumed, enables the CNO cycle to become a tri−cycle, with the third cycle being $^{17}O(p, \gamma)^{18}F(e^{+}\nu)^{18}O(p,\alpha)^{15}N$. The slow rate of ^{17}O destruction can cause an ^{17}O enrichment in CNO burning regions. Convection in red giants could mix some of this ^{17}O out to the surface and thus provide a possible explanation for the recent observations of ^{17}O enrichment in stars. (auth)

17913 A SEARCH FOR SOFT X−RAY EMISSION FROM RED−GIANT CORONAE. Margon, B. (Space Sciences Laboratory, University of California, Berkeley); Mason, K.O.; Sanford, P.W. Astrophys. J. Lett. 194: No. 2, L75-L77 (1 Dec 1974).

Hills has pointed out that if red−giant coronae are weak sources of soft X−rays, then the problems of the identification of the local component of the soft X−ray background and the observed lack of gas in globular clusters may be simultaneously resolved. Using instrumentation aboard OAO Copernicus, we have searched unsuccessfully for emission in the 10−100 Å band from four nearby red giants. In all cases our upper limits are of the order of the minimum theoretically predicted fluxes. Our observations may be used to constrain the mass loss rate of this class of star to $dM_{*}/dT < 5 \times 10^{-9} M_{\odot}\, yr^{-1}$. (auth)

17914 THE REDSHIFT AND COMPOSITE NATURE OF AP LIBRAE (PKS 1514−24). Disney, M.J.; Peterson, B.A.; Rodgers, A.W. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. Lett. 194: No. 2, L79-L82 (1 Dec 1974).

AP Librae, a violent optical variable similar to BL Lac, is found to have a redshift of $z=0.0486$ and to consist of a galaxy with $M_v \sim -21.4$, and an unresolved, starlike core contributing ~70 percent of the total light in the V band. The colors of the quasi−stellar core, $B-V=+0.3$, $U-B=-0.6$, are typical of QSOs. (auth)

17915 EXPERIMENTAL EVIDENCE FOR CNO TRY−CYCLING. Rolfs, C.; Rodney, W.S. (California Institute of Technology). Astrophys. J. Lett. 194: No. 2, L63-L66 (1 Dec 1974).

From an experimental study of the direct capture process in the $^{17}O(p, \gamma)^{18}F$ reaction, the reduced proton widths of the states near the proton threshold are found to be at least a factor of 60 smaller than the previously assumed values. These results imply a corresponding reduction of the stellar reaction rate for the $^{17}O(p, \alpha)^{14}N$ reaction. Since the new upper limit for this reaction rate is of the same order as that for the $^{17}O(p, \gamma)^{18}F$ reaction, a significant part of the hydrogen−burning process of ^{17}O proceeds through the latter reaction, which creates ^{18}O after the β^{+} decay of ^{18}F. Subsequent hydrogen burning of ^{18}O proceeds predominantly ($\geq 99\%$) through the reaction $^{18}O(p, \alpha)^{15}N$. Therefore, the CNO cycle involves two side cycles ^{17}ON and ^{18}ON in addition to the main CN cycle. (auth)

17916 ATMOSPHERE MODELS OF STARS OF LATE SPECTRAL CLASSES. I. Equations of State. Panchuk, V. E. (Odessa Astronomical Observatory). Astrometriya Astrofiz.; No. 22, 37-42(1974). (In Russian).

A modification of the method for solving the system of the dissociation and ionization equations is considered. Tables of electronic pressure for two chemical compositions are given. (auth)

17917 HEAT INSTABILITY OF THE RADIATIVE-CONVECTIVE STAR ENVELOPE ABOVE THE SHELL ENERGY SOURCE. Zhilyaev, B. E.; Redkoborodyi, Yu. N.; Shul'man, L. M. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 22, 30-37(1974). (In Russian).

The paper deals with a linear analysis of stability of the helium envelope above the shell energy source on the boundary of the carbon nucleus. The helium envelope is supposed to be plane and energy source to be thin. The energy output was taken in the form $\epsilon \sim T^{s}$. It is shown that the envelope above the energy source cannot be stable if $S > 3$. The boundary surface between the radiative envelope and outer convection zone makes oscillations of the relaxation type. The considered mechanism of heat instability is supposed to take place in supergiants and in RCrB stars which irregularly change their brightness and radial velocities. (auth)

17918 EQUILIBRIUM OF MATTER IN THE STARS WITH A SHELL ENERGY SOURCE. Zhilyaev, B. E.; Redkoborodyi, Yu. N.; Shul'man, L. M. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 22, 21-30(1974). (In Russian).

The stars with a shell energy source may be thermally unstable. The analytical model is more convenient to investigate these instabilities than the numerical ones. An approximate analytical model of the star envelope is obtained. The mass of the envelope is supposed to be less than that of the isothermal nucleus of the star. Now, it is shown in the plane envelope approximation that the small changes of the shell source temperature provide essential changes in the structure of the radiative−convective atmosphere of the star. (auth)

17919 GRAVITATIONAL CONTRACTION OF PROTOSTARS. II. Evolution of Protostars With Volume Energy Losses. Kolesnik, I. G. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 22, 3-21(1974). (In Russian).

For protostars of solar mass and different chemical composition the laws of gravitational contraction with volume energy losses are considered. The configuration is supposed to have a spherical symmetry, rotation, magnetic field, and external pressure are not taken into account. The computations are performed for five cases: (1) adiabatic contraction, (2) energy losses by molecular hydrogen, (3, 4) two cases of energy losses by dust grains, (5) energy losses by dust grains and heavy elements. Since in the course of collapse the density varies much more than the temperature does, the protostars are rather dense low-temperature formations. Nonhomology of contraction results in separation of the protostar's core surrounded by a shock wave. The core contains 0.1 to 0.2 mass of the protostar, and its subsequent evolution should be calculated taking into consideration the radiative thermal conductivity. For the case of energy losses in molecular hydrogen the radius of the core is about 700 $R_{\odot}$. At the final phases of the considered stage of gravitational contraction there occurs a fast growth of the protostar's energy losses, that evidences for a considerable rise in its luminosity. Therefore the detection of such objects in the infrared range seems to be of interest. (auth)

17920 PROPERTIES OF MATTER IN NEUTRON STARS. Boerner, G. (Goddard Space Flight Center, Greenbelt, MD). Springer Tracts Mod. Phys.; 69: 1-67(1973).

A review of recent developments in the description of neutron star matter is presented, and its relevance to pulsar observations is discussed. Some aspects of the accretion of matter on neutron stars are reviewed, and some of the relevant properties of binary x-ray sources are presented. (auth)

17921 BLACK HOLES: THE OUTSIDE STORY. Stewart, J.; Walker, M. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Springer Tracts Mod. Phys.; 69: 69-115(1973).

The object of this review is to discuss a number of properties of the space-time region outside a black hole within the context of general relativity. Topics considered include motivation, coordinate system and tetrads, test particle trajectories in the Kerr field, tidal forces, and perturbations of the Kerr field. (WDM)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 17777, 17908, 18021, and 18029.

17922 STRUCTURE OF THE ORION NEBULA. Balick, B. (National Radio Astronomy Observatory, Charlottesville, VA); Gammon, R. H.; Hjellming, R. M. Publ. Astron. Soc. Pac.; 86: No. 513, 616-634(Oct 1974).

The Orion Nebula is the best studied of all H_{II} regions. The experimental data of this nebula are reviewed, and interpretive models of the structure of both the nebula and its environs are developed. The H_{II} region is composed of an inner 3′ core surrounding the exciting star $\theta^{1}C$ which is partially imbedded on the near side of a massive neutral complex. A network of strong flows results that resupplies high-density ionized gas to the core region. Gas in the core then freely expands where possible, primarily into the foreground, south, and west. Details of this model are compared with optical, radio, and infrared observations of the ionized, neutral atomic, and molecular gas in the Orion nebula. The nature of the neutral complex is also discussed. (auth)

17923 OPTICAL PROPERTIES OF X−RAY CLUSTERS OF GALAXIES. Bahcall, N.A. (Princeton University Observatory, Princeton, New Jersey). Astrophys. J. 193: No. 3, 529-533 (1 Nov 1974).

A strong correlation of X−ray luminosity with optical classification of galaxy clusters is found by studying all 21 clusters that Kellogg et al. (1973) have suggested may be identified with X−ray sources. No strong correlation of X−ray luminosity with cluster richness is observed, although there is a greater probability for the richer clusters (richness 2) to be X−ray sources. Centers are measured for the clusters that have small X−ray error boxes ($\gg 1$ square degree). A number of the X−ray error boxes do not include the centers of the clusters, but in almost all cases they do include an active radio galaxy or a giant cD galaxy. Core radii of the galaxy distributions have also been measured in four clusters for which X−ray core radii are available; the galaxy distributions have smaller core radii than the X−ray distribution by factors of 2 to 5. (auth)

17924 UPPER LIMIT TO THE X−RAY FLUX FROM THE SUPERNOVA IN NGC 5253 ABOVE 7 keV FROM THE OSO−7. Ulmer, M.P.; Baity, W.A.; Wheaton, W.A. (University of California, San Diego); Peterson, L.E. Astrophys. J. 193: No. 3, 535-537 (1 Nov 1974).

We report upper limits to the X−ray flux from the supernova in NGC 5253 (SN 1972e, optical maximum ~1972 May 4). The observations were made with the UCSD OSO−7 X−ray telescope during 1972 March 29−April 20, August 26−28, and September 29−October 10. The 2σ upper limits above zero flux were respectively 1.2, 5.2, and 1.7×10^{-10} ergs cm^{-2} s^{-1} in the ~7−27 keV range. If a distance of 3.5 Mpc to NGC 5253 is assumed, these limits correspond respectively to 1.7, 7.3, and 2.4×10^{41} ergs cm^{-2} s^{-1}. (auth)

17925 VLB OBSERVATIONS OF THE CRAB NEBULA AND THE WAVELENGTH DEPENDENCE OF INTERSTELLAR SCATTERING. Mutel, R.L. (Department of Astro−Geophysics, University of Colorado, Boulder); Broderick, J.J.; Carr, T.D.; Lynch, M.; Desch, M.; Warnock, W.W.; Klemperer, W.K. Astrophys. J. 193: No. 1, 279-282 (1 Oct 1974).

We have measured the visibility of the Crab Nebula compact component (the pulsar NP 0532) with a 187,000λ VLB interferometer operating at 26.3 MHz. The inferred Gaussian half−power diameter is $1''.30(+0''.23, -0''.13)$. Comparing this with other size determinations of this object, it is concluded that the size scales as λ^n where $n = 2.05\pm0.25$, which implies for s, the turbulence power−law index, a range $3.5 \leqslant s \leqslant 4.3$. This value is consistent with a Gaussian−like distribution of irregularities and some power−law distributions, including a Kolmogorov spectrum. (auth)

17926 INFRARED OBSERVATIONS OF THE RADIO SOURCE G30.8−0.0 IN THE W43 COMPLEX. Pipher, J.L. (University of Rochester, Rochester, New York); Grasdalen, G.L.; Soifer, B.T. Astrophys. J. 193: No. 1, 283-288 (1 Oct 1974).

Infrared observations of the G30.8−0.0 complex are presented. The data, in conjunction with radio data on the same region, imply that dust may be depleted within the region. The presence of an absorption feature at 10 μ is interpreted as due to a cool circumnebular cloud which gives rise to the 100−μ intensity reported by airborne observers. (auth)

17927 OPTICAL SPECTRA AND REDSHIFTS OF 4C QUASI−STELLAR RADIO SOURCES. Schmidt, M. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 193: No. 3, 505-507 (1 Nov 1974).

A spectroscopic survey of Olsen's candidate identifications of quasi−stellar sources in the 20°−40° declination zone of the 4C catalog has yielded 39 confirmed quasars with redshifts ranging from 0.30 to 2.69. (auth)

17928 ON THE NATURE OF FAINT BLUE OBJECTS IN HIGH GALACTIC LATITUDES. III. A SPECTROSCOPIC SEARCH FOR QUASARS IN FOUR SURVEY FIELDS. Schmidt, M. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 193: No. 3, 509-512 (1 Nov 1974).

A spectroscopic survey of 120 faint blue objects in the PHL and LB catalogs has yielded 44 quasars, seven continuous−spectrum objects, and 69 galactic stars. (auth)

17929 AN ANALYSIS OF THE SPECTRUM OF THE LARGE−REDSHIFT QUASI−STELLAR OBJECT OQ 172. Baldwin, J.A. (Lick Observatory, University of California, Santa Cruz); Burbidge, E.M.; Burbidge, G.R.; Hazard, C.; Robinson, L.B.; Wampler, E.J. Astrophys. J. 193: No. 3, 513-523 (1 Nov 1974).

The quasi−stellar object OQ 172, with $z=3.53$, has been observed in detail with the image−dissector spectrum scanner on the Lick 120−inch (3−m) telescope. A list is given of 175 absorption lines; considerable line blending is still present. Analysis of the absorption lines show that multiple redshift systems are present. The best−determined system, at $z=3.066$, has lines from excited fine−structure levels in the ground states of Si II and C II. Other possible systems have $z=2.564$, and close pairs at $z=3.094$, 3.089 and 2.698, 2.691. Lyman lines at a very large number of discrete redshifts may be present. There is no detectable absorption at the Lyman limit at the emission−line redshift, and $L\beta$ if present is quite weak. The absorption−line systems also show little Lyman continuum absorption. Some limits are derived on the thickness, density, and distance from the central source of the absorbing clouds. (auth)

17930 PHYSICS OF COMPACT NONTHERMAL SOURCES. III. ENERGETIC CONSIDERATIONS. Burbidge, G.R.; Jones, T.W.; O'Dell, S.L. (Department of Physics, University of California, San Diego). Astrophys. J. 193: No. 1, 43-54 (1 Oct 1974).

Equations are given for calculating the energy content of compact incoherent electron−synchrotron sources. Numerical results are given in tables for 3C 84, 3C 120, 3C 273, 3C 279, 3C 454.3, CTA 102, 3C 446, PKS 2134+004, VRO 42.22.01, and OJ 287, assuming that the low−frequency turnovers in the radio spectra are due to self−absorption and that the electron distribution is isotropic. Variants on the canonical model involving (a) alternative explanations for the low−frequency turnover, (b) relativistic motions of different types, (c) proton− rather then electron−synchrotron radiation, are discussed. The derived parameters are very sensitive to the adopted source decomposition and to the angular size. Conversely, the very weak dependence of the observables upon details of the physical properties adds insight to the Compton luminosity explanation given by Kellermann and Pauliny−Toth for the nearly constant maximum brightness temperature. Lower limits to the calculated total energies in electrons and magnetic field range from about 10^{52} to 10^{58} ergs if no corrections are made for possible relativistic motion in some sources. If the rapid time variations in 3C 454.3 and CTA 102 are produced by highly relativistic motion ($\gamma_0 \geq 20$), then the resulting increase in the magnetic energy, and the energy expended in the expansion of the source in a gaseous medium, may lead to total energy requirements well in excess of 10^{60} ergs. Since outbursts have been observed every few years, the total energy expended could be very large indeed. Conventional ways of accounting for this energy may then be inadequate unless the sources are closer than their cosmological distances. The importance of VLBI and scintillation monitoring of some sources to decide between the canonical interpretations and some classes of alternatives is stressed. (auth)

17931 THE RAPIDLY VARIABLE RADIO SOURCE 3C 120. Seielstad, G.A. (Owens Valley Radio Observatory, California Institute of Technology). Astrophys. J. 193: No. 1, 55-61 (1 Oct 1974).

Flux density and very−long−baseline interferometric measurements of 3C 120 at several wavelengths and times have been analyzed in terms of a model proposed by Ozernoy and Sazonov. Highly satisfactory agreement is achieved if explosive outbursts, each releasing a few times 10^{51} ergs, have occurred approximately every 1.2 years since 1967.0. Each outburst ejects a pair of radio plasmoids in opposite directions at moderately relativistic velocities. The individual components expand, also relativistically, as they travel outward. The rate of component expansion is just sufficient to ensure that inverse Compton losses are negligible. (auth)

17932 HELIUM IN SOUTHERN H II REGIONS. Danziger, I.J. (European Southern Observatory, Santiago, Chile). Astrophys. J. 193: No. 1, 69-71 (1 Oct 1974).

Optical observations of the helium abundances in the southern H II regions NGC 3576, RCW 38, and NGC 6357 show that all have $N(He^+)/N(H^+) \simeq 0.11$. The difference between this result and the low value for NGC 6357 obtained from radio recombination−line observations is discussed. (auth)

17933 NUMERICAL STUDY X-RAY INDUCED MASS TRANSFER IN THE HZ Herculis/Hercules X−1 BINARY SYSTEM. Alme, M.L.; Wilson, J.R. (Lawrence Livermore Laboratory, University of California, Livermore). Astrophys. J. 194: No. 1, 147-164 (15 Nov 1974).

Attenuation and diffusion of a beam of X−rays incident on the surface of HZ Her are calculated. Atmospheric hydrogen is assumed to be in LTE. All other elements are treated non−LTE. Compton scattering and energy exchange are included. These time−dependent calculations incorporate hydrodynamics with radiation pressure. Our calculations indicate that (a) The mass loss rate $\dot{M}$ is too small to sustain a self−excited accretion−powered X−ray mechanism unless the photosphere is close to the Roche limit. (b) $\dot{M}$ is insensitive to differences in spectral shape between blackbody and exponential fits to the observed Her X−1 X−ray spectrum. (c) For a fixed energy flux per unit area, M is a mild function of the angle of incidence for the X−rays. (d) Reducing by 10 the relative abundance of elements with $Z > 2$ decreases $\dot{M}$ by 7.3, while increasing by 2 the relative abundance of elements with $Z > 2$ increases $\dot{M}$ by 1.8. (e) Assuming cosmic abundances, the optical modulation resulting from 1.24^{s} pulsed X—rays is about 18 percent. Time—of—flight smearing over the surface of the star will not reduce this modulation to the observed values. The optical modulation decreases as the relative abundance of materials with $Z>2$ is decreased. (f) With reduced abundances for $Z > 2$, a large—amplitude pulsation of 3—hour period occurs. (auth)

17934 RADIO OBSERVATIONS OF THE INFRARED SOURCE AFCRL 809—2992. Brown, R.L. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. Lett. 194: No. 1, L9-L11 (15 Nov 1974).

The nature of the compact H II region associated with the infrared source AFCRL 809—2992 is explored by observations at 2695 and 8085 MHz. As the radio source is partially resolved at a baseline of 2.7 km, the angular diameter may be determined $\theta=2.''4\pm0.''4$ and from this the electron density is found to be 2.5×10^{4} cm^{-3}. The Lyman continuum luminosity necessary to excite the nebula may be provided either by a BO.5 main—sequence star or a pre— or post—main—sequence star of somewhat later spectral type. Further observations that may allow one to distinguish between these possibilities are suggested. (auth)

17935 SOME PROBLEMS WITH THE RADIO SOURCE CYGNUS X—3. Hjellming, R.M.; Brown, R.L.; Blankenship, L.C. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. Lett. 194: No. 1, L13-L18 (15 Nov 1974).

Radio data on the Cyg X—3 radio source taken during 1972 September—October show that the decay of major events cannot be adequately described by either an exponential or a power law, but rather there is a transition from an exponential decay with time to a power—law decay with time. In addition, there are repeatable cycles of short—time—scale modulation of the overall variations that recur with an apparent period of 1 day—exactly five times the known period of the infrared and X—ray source associated with Cyg X—3. It is suggested that these phenomena are related to the ejection and acceleration of relativistic particles as manifested by the binary characteristics of the system responsbile for particle ejection. (auth)

17936 RELATIVISTIC-PARTICLE BEAM INSTABILITIES AND X—RAY PULSE PRODUCTION BY THE CRAB PULSAR. Hardee, P.E.; Rose, W.K. (Astronomy Program, University of Maryland, College Park). Astrophys. J. Lett. 194: No. 1, L35-L37 (15 Nov 1974).

The pulsar in the Crab Nebula emits optical and X—ray pulsed radiation. In this Letter we point out that transverse electromagnetic plasma instabilities, sometimes referred to as Weibel instabilities, provide a plausible physical basis for the origin of these pulses. Because of the physical constraints on this instability mechanism, it would be expected that only in very young pulsars could electromagnetic waves become unstable inside the light cylinder. (auth)

17937 THREE GALACTIC H_2O SOURCES. Baudry, A.; Welch, W. J. (Univ. of California, Berkeley). Astron. Astrophys.; 31: No. 4, 471-473(Apr 1974).

A search for 22 GHz water-vapor emission in OH infrared stars, and in complex H II regions, has been conducted at the Hat Creek Observatory of the University of California. Three new H_2O sources displaying 1.35 cm time variation are briefly discussed. Continuum observations (22 GHz) of stars are also reported. (auth)

17938 SURVEY OF FINE STRUCTURE IN GALACTIC H II REGIONS. Felli, M. (Osservatorio Astrofisico di Arcetri, Firenze, Italy); Tofani, G.; D'Addario, L. R. Astron. Astrophys.; 31: No. 4, 431-439(Apr 1974).

A sample of 140 galactic H II regions has been observed with an east-west equivalent half-power beam-width of 16.1 s of arc at a wavelength of 2.8 cm. Angular structure smaller than one minute of arc and stronger than 1 fu was found in 26 regions, 19 of which had not previously been observed with such a high resolution. Taking into account the sensitivity limit of the survey, it is estimated that roughly 28% of all H II regions show compact angular structure. (auth)

17939 PULSE INTENSITY HISTOGRAMS OF PULSARS. Hesse, K. H.; Wielebinski, R. (Max-Planck-Institut fuer Radioastronomie, Bonn). Astron. Astrophys.; 31: No. 4, 409-413(Apr 1974).

Pulse intensity histograms were calculated for 11 pulsars observed at 2695 MHz. These and previously published histograms were grouped into three categories according to position and number of histogram maxima. The relationship between the histogram group and some of the observed properties of pulsars is discussed. (auth)

17940 MAP OF THE OH ABSORPTION IN THE DIRECTION OF W 28. Pastchenko, M. I. (Moscow State Univ.); Slysh, V. I. Astron. Astrophys.; 35: No. 1, 153-155(Sep 1974).

A map of the 1667 MHz OH absorption was constructed from observations with an angular resolution of 3.4′ × 18′. Two molecular clouds are evident, the strongest forming an arc around the nonthermal supernova shell of W 28. The 1720 MHz maser emission source is in the center of the cloud. The observations give evidence for a possible physical association between the supernova, the maser source, and the molecular cloud. (auth)

17941 PHOTOELECTRIC OBSERVATIONS OF LOW RADIO-EMISSION QUASARS. Battistini, P. (Univ., Bologna); Braccesi, A.; Formiggini, L. Astron. Astrophys.; 35: No. 1, 93-97(Sep 1974).

Photoelectric measurements are given for bright blue objects ($14.5 \leqq m_b \leqq 17.5$) identified with radiosources of the B 2.1 and B 2.2 catalogues at 408 MHz. From these data the distribution function $\psi(R)$ of the ratio R between radio and optical power has been computed. The discrepancy with the $\psi(R)$ function from the high sensitivity radiodetections of QSO's, as found by Fanti et al. (1973), is confirmed. (auth)

17942 INTERACTION OF HOT STARS AND THE INTERSTELLAR MEDIUM. VI. Optical Study of the Bright Hα-Knots Sh2-156 and Sh2-157A. Deharveng, L. (Observatory, Marseille). Astron. Astrophys.; 35: No. 1, 63-69(Sep 1974).

Optical observations are presented of two compact H II regions Sh 2—156 and Sh 2—157A. Sh 2—156 is formed of several bright condensations of high electron density, ($N_e \sim 19000$cm^{-3} for the brightest), surrounding a dark area containing the probable exciting star. It is associated with a giant dust cloud containing neutral gas and molecules, where stars are still in formation. The bright Hα-knot Sh 2—157A is physically associated with the diffuse extended nebula Sh 2—157 on which it is projected. The electron densities are lower in this object ($N_e \leqq 3000$ cm^{-3}) than in Sh 2—156. Evidence is presented for the existence of large electron density fluctuations inside, as well as for the presence of dust and neutral dense material. (auth)

17943 SURROUNDINGS OF PULSARS. Schoenhardt, R. E. (Univ., Bonn). Astron. Astrophys.; 35: No. 1, 13-16(Sep 1974).

Maps of the surroundings of 6 pulsars near the galactic plane, based on observations at a wavelength of 11 cm, are presented. The new results are discussed together with previous observations of 19 areas around pulsars. The galactic nonthermal shell source G 55.7 + 3.4 at the position of the pulsar PSR 1919 + 21 is found to be an exceptional case among the 25 observed fields and is interpreted as a distant supernova remnant, not physically associated with the pulsar. Chance associations of pulsars with distant old supernova remnants are expected to be quite frequent near the galactic plane, so that the proximity of possibly two weak supernova remnants to two of the observed pulsars does not seem to be surprising. The absence of any observed radio continuum radiation from the surroundings of pulsars—possibly except for the case of the pulsar PSR 0611 + 22—suggests that the relativistic particles, which are commonly assumed to be produced by pulsars, manage to escape very rapidly into the interstellar medium. (auth)

17944 IDENTIFICATION OF TYPE I OH MASERS WITH VERY SMALL H II REGIONS. Habing, H. J. (Observatory, Leiden); Goss, W. M.; Matthews, H. E.; Winnberg, A. Astron. Astrophys.; 35: No. 1, 1-5(Sep 1974).

The radio continuum radiation at 6 cm was mapped with a resolution of ($7 \times 7/\sin\delta$) arcsec in 11 fields surrounding 13 OH Type I masers. In all fields sources less than 1 arcmin in size were found. In 7 cases a source smaller than 4 arcsec was found to coincide within 1.5 arcsec with the OH maser position. These sources are thought to be very compact H II regions. It is concluded that many, and possibly all Type I OH masers occur near stars that have recently arrived at or very near the main sequence and that have started to ionize the remaining gas from the collapsing prestellar cloud. It is suggested that the OH maser phenomenon disappears when the H II region has expanded to sizes greater than some 15,000 AU. (auth)

17945 MEASUREMENTS OF THE POSITION OF X-RAY SOURCES WITH COPERNICUS. Willmore, A. P.; Mason, K. O.; Sanford, P. W.; Hawkins, F. J.; Murdin, P.; Penston, M. V.; Penston, M. J. (Univ. of Birmingham, Eng.). Mon. Notic. Roy. Astron. Soc.; 169: No. 1, 7-23(Oct 1974).

Positional observations of nine galactic x-ray sources made with the Copernicus satellite are presented. For five of these, improved positions are given with accuracies of about ±0.5 arcmin and a model spectrum is fitted to the data. It seems likely that two sources (3U 1728—16 and 1758—20) show variation in the low energy cut-off. The positions of four candidate stars proposed by Gursky were also examined. The results exclude three of them as identifications while only a weak signal was received from the fourth and its identification is still unconfirmed. The number of chance associations of bright stars with x-ray positions is evidently greater than the 2.8 estimated by Gursky. (auth)

17946 OH 26.5 + 0.6: A STRONG OH SOURCE AT 1612 MHz. Andersson, C. (Onsala Space Observatory, Sweden); Johansson, L. E. B.; Goss, W. M.; Winnberg, A.; Nguyen-Quang-Rieu. Astron. Astrophys.; 30: No. 3, 475-477(Feb 1974).

A strong OH source (OH 26.5 + 0.6) has been found at 1612 MHz. The peak flux density is greater than 400 f.u. and is comparable to that of NML Cygnus; in terms of peak flux OH 26.5 + 0.6 is one of the five strongest OH emission sources detected to date. Weak emission is also seen at 1665 and 1667 MHz. The 18 cm properties have similarities to both the Type II OH/ir stars and the supergiant OH/ir stars. (auth)

17947 PHOTOMETRY IN THE CYGNUS X-1 FIELD. Margon, B. (University Coll., London). Astron. Astrophys.; 30: No. 3, 467-469(Feb 1974).

UBV photometry and extinction corrections are presented for 50 stars in the immediate field of the x-ray source Cygnus X-1. An observation to search for rapid photometric variability in HDE 226868, the optical component of the system, is also reported. (auth)

17948 MODEL OF COMPACT H II REGIONS EMITTING IN THE INFRARED. Pottasch, S. R. (Kapteyn Astronomical Inst., Groningen, Ger.). Astron. Astrophys.; 30: No. 3, 371-379(Feb 1974).

The compact H II regions, which are strong emitting sources in the infrared, are studied. The following conclusions are drawn. (1) The size of the region is determined by the luminosity of the source of radiative energy, and the density of the region. (2) The dust grains in these compact regions have the same properties as the dust grains in the general interstellar medium. (3) The correlation between observed infrared flux and observed radio flux can be explained for those cases in which a single star is the energy source; this correlation is a result of the correlation between the temperature and the luminosity of the star. In those H II regions in which many stars are responsible for the heating, it is predicted that no correlation will be observed. (4) The absorption efficiency of the dust grains as a function of wavelength between 20 μ and 350 μ cannot have the form λ^{-n} over the entire range, regardless of the value of n, if the optical depth is small in this wavelength region. (auth)

17949 AN UPPER LIMIT TO AN X–RAY POINT SOURCE AT THE CENTER OF THE CYGNUS LOOP. Weisskopf, M.C.; Helava, H.; Wolff, R.S. (Columbia Astrophysics Laboratory, Columbia University). Astrophys. J. Lett. 194: No. 2, L71-L74 (1 Dec 1974).

The Cygnus Loop was observed with a one–dimensional X–ray telescope. Data from two orthogonal scans showed no evidence for a pointlike remnant of the supernova at the center of the Loop. We set an upper limit to the presence of such a source of 2.9 percent (at 99.9% confidence) of the total emission in the bandwidth from 400 eV to 850 eV. The pulsed component at 62.31 ms suggested by Rappaport et al. was not observed. (auth)

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Refer also to abstracts 17778, 17784, 17798, 17880, 18056, 18061, 18065, 18085, 18088, and 18090.

17950 (BNL-19278) REPORT ON THE BROOKHAVEN SOLAR NEUTRINO EXPERIMENT. Davis, R. Jr.; Evans, J. C. Jr. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 16p. (CONF-740851-1). Dep. NTIS $4.00.

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974).

The Brookhaven solar neutrino experiment has been in operation since 1968. The results of 10 experiments are given that extend over the period June 1971 to Jan 25, 1974. From these results it was concluded that the solar neutrino capture rate in ^{37}Cl is less than 1 SNU (SNU $\equiv 10^{-36}$ captures sec^{-1} atom ^{37}Cl^{-1}). This result can be compared to the rate of 5.6 SNU predicted by standard solar model calculations. One experimental run for the period July 7 to Nov 5, 1972 gave an apparent rate of 6.2 ± 2.1 SNU and is higher than any other single experiment. A search was made for a possible neutrino pulse associated with the Jan 4, 1974 anti-neutrino pulse observed by the Pennsylvania-Texas water Cerenkov detectors. Neutrinos were not observed and a limit was set to the ratio of $\bar{\nu}/\nu \geq 4$ if the Jan 4th event was produced by antineutrinos. A discussion is given of various tests performed to measure the recovery of ^{37}Ar in the detector system. New experiments to test further the argon recovery, and to measure the neutrino capture cross section in ^{37}Cl are briefly described. (auth)

17951 (BNL-19300) FEASIBILITY STUDIES ON A RADIOCHEMICAL LITHIUM SOLAR NEUTRINO EXPERIMENT. Rowley, J. K. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 15p. (CONF-740851-2). Dep. NTIS $4.00.

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974).

The feasibility of performing a radiochemical lithium solar neutrino experiment is presently under study at Brookhaven National Laboratory. The progress of these studies is reported. Good progress was made on the separation of the product, ^{7}Be, from the target, a 12 M LiCl solution in water. Experimental studies of several suitable efficient methods for achieving this separation are discussed. Possible methods for counting ^{7}Be are listed and the results of some preliminary investigations of some of these methods are reported. Moderate success in Geiger counting ^{7}Be in the gas phase was achieved. Background processes which can also produce ^{7}Be are also listed and the estimated backgrounds due to these processes are reported. (auth)

17952 (COM-73-50681-342-S) SOLAR-GEOPHYSICAL DATA NUMBER 342, FEBRUARY 1973. (Supplement): Descriptive Text. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1973. 89p. (SGD-342-SUPPL). National Climatic Center, Asheville, N. C. 28801 $1.25.

The pamphlet contains the description and explanation of the data contained in the monthly publication "Solar-Geophysical Data". The reports are intended to keep research workers abreast of the major particulars of solar activity and the associated ionospheric, radio propagation, and other geophysical effects. The report series is made possible through the cooperation of many observatories, laboratories, and agencies. (GRA)

17953 HYDROMAGNETIC WAVES IN INTERPLANETARY SPACE. Hollweg, J. V. (National Center for Atmospheric Research, Boulder, CO). Publ. Astron. Soc. Pac.; 86: No. 513, 561-594(Oct 1974).

A brief review is presented of the basic properties of the solar wind along with a straightforward analysis of small-amplitude hydromagnetic waves, which serves as a convenient guide for interpreting the data, and as a reference point for examining the more complex nonlinear phenomena. Representative data illustrating the appearance of the various hydromagnetic wave modes in the solar wind are presented. An extensive discussion is given of the various effects which the waves may have on the solar-wind itself. (WDM)

17954 POSSIBLE VARIATIONS IN THE INTENSITY OF SOLAR ELECTROMAGNETIC RADIATION. Kondrat'ev, K. Ya.; Nikol'skii, G. A. (Leningrad State Univ.). pp 128-135 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

The variability of the solar electromagnetic radiation over the spectral range from 0.14 to 10 microns is investigated with the aim of uncovering fluctuations in the solar constant. The dependence of the hour-by-hour values of this constant on the concurrent number of sunspots is demonstrated. (IAA)

17955 POSSIBLE VARIABILITY OF THE SOLAR CONSTANT ACCORDING TO OBSERVATIONS OF THE SMITHSONIAN INSTITUTE. Vasil'ev, O. B.; Muragin, A. F.; Nikol'skii, G. A.; Rubashev, B. M. (Leningrad State Univ.). pp 446-451 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

Annual mean-weighted values and mean-annual values of the solar constant obtained by the authors were compared with the values obtained at the Smithsonian Institute by the so-called long and short methods. It is found that the fluctuations of the solar constant calculated on the basis of the Smithsonian observations may be decomposed into compound oscillations which are well correlated with fluctuations of the sunspot numbers and are very well correlated with possible fluctuations of the solar radius. Consequently, the variations of the solar constant may be represented in the form of a sum of the two above-mentioned oscillations with appropriate approximate-regression coefficients. (IAA)

17956 CURRENT VIEWS ABOUT THE REALITY OF CORPUSCULAR-ATMOSPHERIC RELATIONS. Mustel, E. R. pp 7-18 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

Results about the effects of solar corpuscular streams on the lower layers of the atmosphere are presented. A statistical analysis of these results is shown to lead to a positive conclusion about the reality of corpuscular-atmospheric effects. (IAA)

17957 PARTICLE ENVIRONMENT IN SPACE. Siscoe, G. L. (Univ. of California, Los Angeles). pp 23-45 of Photon and Particle Interactions with Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

A review is presented on the charged and neutral particles in the solar system, particularly in the vicinity of Earth. The average values and ranges of the parameters characterizing the charged particle flux from the Sun (the solar wind), mainly protons and electrons, are given as are the correlations between the parameters for large-scale fluctuations. Aerodynamics calculations give the physical conditions of the shocked solar-wind plasma in the region between the Earth's bow shock and the boundary with the geomagnetic cavity. The charged particle population inside the geomagnetic cavity and the geomagnetic tail is highly structured both in its spatial distribution and in energy. The average properties and dynamical behavior of the polar cusp, plasma sheet, ring current, and plasmasphere populations are described. Models and dynamical behavior of the neutral particles in the Earth's exosphere are given. (auth)

17958 KINETIC THEORY ANALYSIS OF SOLAR WIND INTERACTION WITH PLANETARY OBJECTS. Wu, S. T. (Univ. of Alabama, Huntsville); Dryer, M. pp 453-470 of Photon and Particle Interactions with Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

A purely kinetic treatment is proposed for the interaction of the solar wind with any small planetary object. Small refers to those cases where the solar-wind proton's thermal gyroradius is arbitrarily taken to be greater than 0.1 radius of the object under investigation. The "object" may possibly include an ionosphere or magnetosphere. The collisionless Boltzmann equation, neglecting the magnetic field, is used to calculate steady-state profiles of density and velocity around the obstacle. A low-density plasma void in the umbral region and a compression in the penumbral region are clearly found. The present technique, despite its neglect of the interplanetary magnetic field, is proposed as an alternative zeroth order approach to the continuum, local magnetic anomaly, and guiding center approaches used by others for the particular case of the Moon. Some recent, potentially relevant, observations on and in front of the Moon are discussed. (IAA)

17959 PHOTOELECTRONS AND LUNAR LIMB SHOCKS. Criswell, D. R. (Lunar Science Inst., Houston, TX). pp 443-451 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

It is suggested that boundary conditions for solar wind/lunar limb interactions are active. The "whole-moon" limb does not evoke a shock cone because warm solar-wind electrons are replaced by cool photoelectrons that are ejected from the generally smooth areas of the lunar terminator illuminated at glancing angles by the Sun. A localized volume of low thermal pressure is created in the solar wind by these cool photoelectrons. The solar wind expands into this volume without shock production. Directly illuminated highland areas exchange hot photoelectrons for warm solar-wind electrons. The hot electrons generate a localized pressure increase in the adjacent solar-wind flow which evokes a shock streamer in the solar wind. Shock streamers are identifiable by a coincident increase in the magnitude of the solar-wind magnetic field. Shock occurrence is controlled by lunar topography, solar activity in the hard ultraviolet, solar-wind electron density and thermal velocity, and the density of the solar-wind magnetic field. (auth)

17960 OBSERVATION OF TM-MODE INDUCTION IN A SIMULATED SOLAR WIND/MOON INTERACTION. Srnka, L. J. (Culham Lab., Abingdon, Eng.). pp 481-497 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

The electrical response of the Moon to electromagnetic action by the solar wind contains a TM mode which is driven by the solar-wind electric field and its variations and which is characterized by currents that flow from the Moon and close in the solar wind. A solar-wind simulation experiment, VORTEX, has been built to study the plasma aspects of the TM mode response. VORTEX provides a quasi-steady, reproducible, fully ionized argon plasma flow transverse to a magnetic field, by E × B drift around an annular chamber. Cylindrical obstacles of various electrical conductivities are inserted into the flow, along the magnetic field lines. TM mode currents have been detected in a graphite obstacle by a Rogowski coil buried in the obstacle. These observations suggest that a more complex model, which includes surface effects, is needed to describe the solar-wind interaction with a Moon-like object if the TM mode response is present. (IAA)

17961 THE INTERSTELLAR WAKE OF THE SOLAR WIND. Yu, G. (Department of Physics, University of Chicago). Astrophys. J. 194: No. 1, 187-202 (15 Nov 1974).

The properties of the downstream wake of the solar wind and its ultimate fate are discussed. The interstellar hydrogen gas which penetrates into the solar wind is responsible for cooling of the subsonic solar wind in the wake. In the case where the spin axis of the Sun is parallel to the incident interstellar flow, the lines of force of the magnetic field in the wake form a spiral, and the solar wind plasma is pushed into the center of the wake by the tension of the lines of force. As for the case where the spin axis is perpendicular to the incident flow, the field is in two parallel spirals in the wake. The plasma is concentrated in the center of each spiral, and two tails of the same size are formed. For an oblique angle with the incident flow, two tails—one large and one small—are expected. It is well known that the directions of adjacent interplanetary field sectors are reversed. Hence, the field in the wake dissipates mainly through the reconnection of the lines of force at the neutral points between sectors. The lifetime of the field and the solar wind plasma is of the order of 10^{10} s. The length of the wake is of the order of 10^3 a.u. Thus the wake is relatively short, and the Sun does not leave an extended tail through interstellar space. (auth)

17962 RESISTIVE DIFFUSION OF FORCE–FREE MAGNETIC FIELDS IN A PASSIVE MEDIUM. IV. THE DYNAMICAL THEORY. Low, B.C. (High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado). Astrophys. J. 193: No. 1, 243-252 (1 Oct 1974).

We consider the subsequent resistive diffusion of an initially force–free magnetic field in a tenuous medium, initially at rest. The inertia of the medium, which we neglected in the previous papers of this series, is now taken into account. We treat the one–dimensional case by an expansion of both the momentum and the hydromagnetic induction equations in terms of the parameter $\epsilon = A\eta/V_0$ in the limit of $\epsilon \ll 1$. Here A^{-1} is a typical length scale, η the constant resistive coefficient, and V_0 is the Alfvén speed. It is found that within the Alfvén transit time $t_0 = 2(AV_0)^{-1}$, a small nonzero Lorentz force sets in and accelerates the medium to move in a manner such that the magnetic field may remain almost force–free for an extended period of time of the order $t_1 = V_0/\eta^2A^3$. During this period of time, inertial effects remain negligibly small, and the situation to the lowest order is in fact as described in the earlier papers of this series. We suggest that in this way the intense magnetic fields in the solar chromosphere can persist for a time longer than 10^8 s. (auth)

17963 DEUTERIUM, TRITIUM, AND HELIUM–3 PRODUCTION IN SOLAR FLARES. Ramaty, R.; Kozlovsky, B. (Laboratory for High Energy Astrophysics, Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 193: No. 3, 729-740 (1 Nov 1974).

We evaluate in detail the production of deuterium, tritium, and helium–3 from nuclear reactions of accelerated charged particles with the ambient solar atmosphere. We use updated cross–sections and kinematics, we extend our calculations to very low energies (~0.1 MeV per nucleon), and we calculate the angular distribution of the secondary particles. We then compare the calculations with data on accelerated isotopes from solar flares. In particular, we consider the 1972 August events for which both ^{3}He and nuclear γ–rays were observed. Finally, we provide a possible explanation for ^{3}He–rich events in terms of the angular distributions of secondary isotopes, and we make predictions on the flux of 2.2–MeV γ–rays from such flares. (auth)

17964 MECHANISM OF SOLAR ACTIVITY EFFECTS IN THE CIRCULATION OF THE EARTH'S ATMOSPHERE. Sytinskii, A. D. pp 281-287 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

The effect of solar activity on atmosphere circulation is interpreted as a disturbance of the quasi-stationary motion of the atmosphere resulting in increased macroturbulent mass transfer with thermobaric field transformation and increased cyclone and anticyclone activities. An analysis of atmospheric disturbance energy balance is conducted to substantiate this interpretation. (IAA)

17965 MECHANISM OF TEMPERATURE AND PRESSURE VARIATION IN THE EARTH'S ATMOSPHERE DURING SOLAR FLARES. Reshetov, V. D. pp 288-296 of Sun–Atmosphere

Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17966 ALTERATION OF O_3 AND NO MOLECULE ORIENTATION WITH RESPECT TO THE GEOMAGNETIC FIELD AS A POSSIBLE INDICATOR OF SOLAR ACTIVITY EFFECTS IN THE LOWER LAYERS OF THE ATMOSPHERE. Usmanov, I. F. (Chemical-Technological Inst., Kazan). pp 297-300 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17967 STATISTICAL PROGNOSTICATION TAKING INTO ACCOUNT SOLAR ACTIVITY. Dmitriev, A. A. pp 381-385 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).
A method for statistical prognosis of ocean and atmospheric processes is presented, with allowances for changes due to solar activity. Two types of solar effects can be considered. In one, solar activity is regarded as a factor changing the background of geophysical processes, and in the other, solar activity is regarded as a pulse regulator, every oscillation of which causes a response in the geophysical fields. Some prognostic equations are derived. (IAA)

17968 POSSIBLE MECHANISM OF THE RELATION BETWEEN CHROMOSPHERE FLARES AND MESOPAUSE TEMPERATURE FLUCTUATIONS. Svatkov, N. M. (Moscow Pedagogical Inst.). pp 396-399 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17969 EFFECTS OF SOLAR ACTIVITY ON THE FREQUENCY OF FORMATION OF LARGE ANOMALIES IN ARCTIC REGIONS. Bolotinskaya, M. Sh. pp 80-86 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).
Variations in the frequency of formation of large summer (June-August) pressure and temperature anomalies in Arctic regions over many years are associated with variations in solar activity. It is shown that solar activity exerts a definite influence on the frequency of large anomaly formation in Arctic regions. (IAA)

17970 WIND FIELD VARIATIONS AT ALTITUDES OF 6 TO 120 KM IN CONNECTION WITH SOLAR ACTIVITY. Kazimirovskii, E. S.; Loginov, V. F.; Sukhomazova, G. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Irkutsk, USSR). pp 96-101 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17971 CHANGES IN ATMOSPHERIC CIRCULATION DUE TO VARIATIONS IN SOLAR ACTIVITY, AND WIND FIELD CHANGES AT ALTITUDES OF 80 TO 110 KM FOLLOWING SOLAR-GEOMAGNETIC DISTURBANCES. Teptin, G. M. (Kazan State Univ.). pp 102-110 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17972 ENERGY CHANGES IN THE ATMOSPHERE AND THEIR RELATION TO SOLAR ACTIVITY. Borisenkov, E. P. pp 111-120 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).
The mean yearly variation of useful potential energy in the atmosphere was integrated over the period 1958-1968 and graphed along with curves showing the annual variations in Wolf number and geomagnetic index for the same period. The similarity of the curves shows that a definite relation exists between solar activity and the appearance of additional energy in the atmosphere. (IAA)

17973 CHANGES IN THE KINETIC ENERGY OF THE ATMOSPHERE RELATED TO THE EARTH'S ENTERING A CORPUSCULAR STREAM. Poloskin, G. E. pp 121-127 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17974 SOLAR ACTIVITY EFFECTS IN THE ELECTROMAGNETIC SPECTRUM OF SOLAR RADIATION. Molchanov, A. P. (Leningrad State Univ.). pp 136-142 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).
Data on solar radiation characteristics pertinent to the problem of solar–atmospheric relations are reviewed. Special attention is given to indices that may make it possible to utilize solar emissions in forecasts of intense solar flares and of their consequences for the Earth's atmosphere. (IAA)

17975 ROLE OF INITIAL CONDITIONS IN PRESSURE FIELD TRANSFORMATIONS. Mustel, E. R. pp 143-148 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).
The present work examines the significance of initial atmospheric conditions in studying corpuscular–atmospheric effects, whereby "initial conditions" means the conditions at the time when the Earth crosses a stream of solar corpuscular radiation. On the basis of numerous pressure charts of a given region for various times just before and then after the onset of solar–atmospheric interaction, it is shown that if in a given local region there is a sharp anomaly in pressure (e.g., there is a cyclone or anticyclone), then the change in pressure of corpuscular nature can be strongly distorted, since the solar corpuscular stream will have to expend a good deal of energy in breaking up the given pressure formation. (IAA)

17976 REACTION OF THE ATMOSPHERE TO SOLAR DISTURBANCES. Mikhnevich, V. V. pp 168-180 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).
Experimental data on the variation of wind and atmospheric thermodynamic parameters during periods of solar disturbances were analyzed. It was observed that during solar activity, reactions take place from the troposphere to the thermosphere, that is, there exists a relation between events in the upper and lower atmosphere. Also, it was found that variations in atmospheric parameters correlate to changes in the geomagnetic index, and that during reorganization of temperature stratification, the sign of temperature change is different at different altitudes. (IAA)

17977 INTERACTIONS BETWEEN THE UPPER AND LOWER LAYERS OF THE EARTH'S ATMOSPHERE FOR QUIET AND DISTURBED PERIODS OF SOLAR ACTIVITY. Rakipova, L. R. pp 161-167 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17978 ROLE OF INHOMOGENEITIES IN THE EARTH'S CRUST IN THE INFLUENCE OF SOLAR ACTIVITY ON THE ATMOSPHERE. Usmanov, R. F. pp 149-160 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).
The present work discusses the significance of inhomogeneities in the Earth's crust and of processes taking place in the Earth's interior for studies of the sun–atmosphere interactions. The development of gravitational and magnetic anomalies in the atmosphere is analyzed. A proposal is made for dividing the fields of atmospheric pressure and air temperature into a constant and variable component, as is done for the analysis of the magnetic field. (IAA)

17979 ANALYSIS OF THE RELATIONS BETWEEN THE ACTIVITY OF THE SUN AND THE PROCESSES IN THE HIGH-LATITUDE ATMOSPHERE. Bekoryukov, V. I.; Bugaeva, I. V.; Kokin, G. A.; Ryazanova, L. A.; Tulyakov, V. V. pp 198-206 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).
From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

The effects of solar flares and concurrent geomagnetic disturbances upon the condition of the atmosphere are considered in light of some investigation results obtained in 1968-1969. It is shown that increasing geomagnetic disturbances induce steep pressure rises in upper atmosphere layers. (IAA)

17980 SOME ENERGY ASPECTS OF THE INTERACTION BETWEEN THE INTERPLANETARY MEDIUM AND THE EARTH'S MAGNETOSPHERE. Kovalevskii, I. V. pp 207-221 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

Some energetic aspects of interrelated phenomena occurring on the Sun, in interplanetary space, in the magnetosphere, ionosphere, atmosphere, and on the surface of the Earth are considered. Basic data on the interplanetary medium and the geomagnetosphere are reviewed, and special attention is given to the radiated solar energy, particularly that from active solar regions, which induces most of the physical processes in the interplanetary medium and geomagnetic cavity. Estimates of density are presented for fluxes of various kinds of energy over 1 AU in interplanetary space and for energy fluxes incident on the magnetosphere, along with estimates of magnetic storm energy parameters. (IAA)

17981 MECHANISM OF CORPUSCULAR PHENOMENA IN THE ATMOSPHERE. Mustel, E. R. pp 222-228 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

It is theorized that 1 to 10-micron ir radiation propagating downward from ionospheric layers and enhanced during the passage of the Earth through a solar corpuscular stream can be responsible for atmospheric instabilities such as cyclones, anticyclones and disturbances in atmospheric circulation. According to this theory the 5.3 and 4.3-micron radiations emitted by NO molecules and positive NO ions are major contributors to atmospheric corpuscular phenomena leading to atmospheric instabilities. (IAA)

17982 OCEAN–CONTINENT BOUNDARY ZONES AND THEIR ROLE IN THE MANIFESTATION OF THE EFFECT OF SOLAR CORPUSCULAR RADIATION ON THE EARTH'S ATMOSPHERE. Smirnov, R. V. pp 240-247 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17983 RELATION BETWEEN THE SECTORAL STRUCTURE OF THE INTERPLANETARY MAGNETIC FIELD AND ATMOSPHERIC PRESSURE AT CONJUGATE POINTS AND A STATISTICAL ANALYSIS OF THIS RELATION. Mansurov, S. M.; Mansurova, L. G.; Mansurov, G. S. pp 259-270 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun– atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17984 EFFECTS OF LONG-PERIOD SOLAR ACTIVITY FLUCTUATIONS ON PRESSURE AND TEMPERATURE OF THE ATMOSPHERE. Rubashev, B. M. pp 43-55 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

Results of previous global-scale investigations of pressure and temperature variations through 11-year solar cycle phases are presented, as well as new data on atmosphere pressure and temperature variations through the 11-year solar activity cycle. The effects of a 22-year solar activity cycle on atmosphere temperature and pressure are considered, along with variations in atmosphere pressure and temperature through 80- to 90-year solar cycle phases, in the light of current views on the mechanism linking solar activity with tropospheric processes. (IAA)

17985 VARIATIONS IN TROPOSPHERIC CIRCULATION RELATED TO THE EFFECT OF THE INHOMOGENEOUS STRUCTURE OF THE INTERPLANETARY MEDIUM. Smirnov, R. V. pp 33-42 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17986 CYCLICITY OF SOLAR RADIATION AND ITS PROGNOSTIC SIGNIFICANCE. Buchinskii, V. E. pp 424-428 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

A method is described for seasonal and monthly forecasting of weather and grain crop yields which is based on an observed solar radiation cyclicity. It is shown that in the territory investigated (parts of the Ukraine and the Crimea) the levels of solar radiation during the months of the vernal and autumnal equinoxes and the summer and winter solstices predetermine the nature of future seasonal and monthly weather changes. Grain crop yields are predetermined by both October and March radiation. In both cases the crop yield is inversely related to the values of the solar radiation for these months. (IAA)

17987 PECULIARITY OF SOLAR TYPE III RADIO BURST GENERATION BY STABILIZED FAST-PARTICLE STREAMS. Zaitsev, V. V. (Scientific-Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 10, 1438-1445(1974). (In Russian).

It is shown that there may be two excitation regimes of Type III bursts when a stabilized (in particular, proton) stream with a small dispersion is instantaneously injected into the corona. If the characteristic time scale of the stream is small compared with the time of plasma wave attenuation due to electron–ion collisions in the corona, the burst profile at the fixed frequency has a smoothly increasing front with a subsequent smooth attenuation. This case is qualitatively analogous to Type III burst generation by a nonstabilized stream. When the time scale is larger than the collision time, the Type III burst profile is of quasi-oscillatory character, i.e. differs essentially from the time profile in the case of generation by a nonstabilized stream. The Type III bursts with a quasi-oscillatory structure of the time profile testify to the fact that the stabilization effects may play though rather seldom play the definite role in expansion of fast-particle streams in the corona. (auth)

17988 SOLAR RADIATIVE TRANSFER IN CLOUDS USING EDDINGTON'S APPROXIMATION. Zdunkowski, W. G. (Univ. of Utah, Salt Lake City); Junk, R. J. Tellus; 26: No. 3, 361-368(1974).

The present investigation deals with solar radiative transfer in horizontally stratified clouds. The approach taken is based on the Eddington approximation of radiative intensities applied to Chandrasekhar's (1960) exact formulation of the radiative transfer equation. All important physical processes such as absorption by water vapor and cloud droplets as well as multiple scattering by the cloud droplets are taken into consideration. Comparisons are made with results derived from the exact solution of the radiative transfer equation. The weakness of Eddington's approximation is discussed and an extension of the method is recommended. (auth)

17989 TEMPERATURE FLUCTUATIONS IN SOLAR GRANULATION. Levy, M. (Observatory, Meudon, France). Astron. Astrophys.; 31: No. 4, 451-458(Apr 1974).

The relaxation time of temperature fluctuations is analyzed by means of a hydrodynamic model for convective cells. Account is taken of radiative transfer. First, two-dimensional checkerboard temperature and density fluctuations are introduced into a realistic model atmosphere (HSRA), and then the effect of three-dimensional nonuniform transfer is studied. The instantaneous relaxation time at the origin ($\tau_T = 1/\beta$) is obtained in terms of various parameters: granulation scale, penetration coefficient, velocity, the amplitude of temperature fluctuations. The resulting curves of $\beta(z)$ are among the most accurate derived to date. It is also shown that the instantaneous relaxation time τ_T is very short compared to granule life-times. Results for the disk-center contrast and the variation in center-to-limb contrast of granules are compared to those of Edmonds so as to scale the mean values of the parameters used to describe temperature and density perturbations. Intensity fluctuations are highly dependent on fluctuations in opacity. (auth)

17990 EXCITATION AND DECAY OF LOW FREQUENCY TYPE III SOLAR RADIO BURSTS. Bradford, H. M.; Hughes, V. A. (Queen's Univ., Kingston, Ontario). Astron. Astrophys.; 31: No. 4, 419-429(Apr 1974).

The dynamic spectra of a number of Type III solar radio bursts obtained from Alouette I satellite records in the nominal frequency range of 2 MHz to 8 MHz were analyzed. An objective new method of analysis was employed which utilized the measured moments of the shapes of the bursts up to third order. In the model, the burst was assumed to be due to coronal plasma waves excited by a stream of fast charged particles with large velocity dispersion ejected impulsively from the Sun. The received flux was represented as a convolution of functions which mainly represent the excitation and exponential decay of the plasma waves. Deconvolution with the aid of the measured moments yielded an upper limit on the decay time and a measure of the duration of the excitation. Best agreement between the data and the model is obtained if the decay time is equal to the upper limit and the excitation time is mainly caused by velocity dispersion in the excitor stream. The maximum decay times are smaller than typical published values and imply a coronal temperature about 2.5 times smaller at 2 MHz. Some of this difference may be due to systematic error in the conventional method of measuring decay times. (auth)

17991 TRANSFORMATION OF ATMOSPHERIC CIRCULATION AFTER THE EARTH'S ENTERING A SOLAR CORPUSCULAR STREAM. Mustel, E. R. pp 23-32 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

17992 RATE COEFFICIENT OF $H + H^- \rightarrow H + H + e$ REACTION. Janev, R. K. (Geomagnetic Institut, Belgrade). Astron. Astrophys.; 35: No. 1, 161-163(Sep 1974).

The rate coefficient for the collisional electron detachment reaction $H + H^- \rightarrow H + H + e$ is calculated in the temperature region from 100°K to 2000°K. It is shown that this rate coefficient, although considerably smaller than that for the corresponding associative detachment process at very low temperatures (~100°K), becomes comparable to the latter already at temperatures of about 3000°K. This is because the collisional electron detachment rate coefficient at low temperatures behaves as $T^{1/2}$. (auth)

17993 STUDY OF LOW DISPERSION ECLIPSE SPECTRA: OBSERVATION OF WEAK LOW EXCITATION EMISSION LINES IN THE CORONA. Stellmacher, G.; Koutchmy, S. (Institut d'Astrophysique, Paris). Astron. Astrophys.; 35: No. 1, 43-48 (Sep 1974).

A spectroscopic experiment, set up to observe simultaneously the electronic, emission line and F-corona, near the equator between 0.1 and 0.8 $R_\odot$ above the Sun's limb, was carried out successfully during the total solar eclipse on June 30, 1973 in the Republic of Tchad. The low excitation line emission in Ca^+, H and K, H_δ, H_γ, H_β is observed superimposed over the entire spectrum, including the lunar background. No radial dependence is observed for the equivalent width of these lines. The emission is interpreted in terms of double scattered light of chromospheric origin in the Earth's atmosphere. The color dependence of the double scattered light is correctly reproduced by a quasi quantitative model confirming the parasitic origin of these lines. (auth)

17994 ROCKET PHOTOMETRY OF THE INNER ZODIACAL LIGHT. Leinert, C.; Link, H.; Pitz, E. (Max-Planck-Institut fuer und Landessternwarte, Heidelberg). Astron. Astrophys.; 30: No. 3, 411-422(Feb 1974).

Observations of the zodiacal light on circles around the Sun at elongation angles between 15 and 30° have been obtained with five rocket-borne telescopes, launched from the ESRO-range at Sardinia on July 2, 1971. It was the first attempt to measure the zodiacal light in the daytime with the noneclipsed Sun near zenith. The stray light suppression proved to be adequate. The brightness was measured at two broad wavelength bands centered at 4755 and 5915 Å. The results provide coverage of the observational gap between the earth-bound measurements of the inner zodiacal light and outer corona data. The observed color is close to that of the Sun, indicating a slight reddening. Polarization measurements at ϵ = 15 and 21° in the blue band give rather high values near the ecliptic and a slight decrease outside. Apparent deviations of the plane of symmetry from the ecliptic are discussed. (auth)

17995 ON THE Fe XXIV EMISSION IN THE SOLAR FLARE OF 1973 JUNE 15. Widing, K.G.; Cheng, C. (E. O. Hulburt Center for Space Research, Naval Research Laboratory). Astrophys. J. Lett. 194: No. 2, L111-L113 (1 Dec 1974).

The double ribbon flare of 1973 June 15 was observed in the XUV wavelength region with the NRL objective grating spectroheliograph during the Skylab missions. The Fe XXIV emissions at 192.1 and 255.2 Å are prominent in the early phase of the flare. The Fe XXIV emission is centered over the neutral line, forming a bridgelike structure between magnetic regions of opposite polarity. This is unlike the emission pattern of He II, the transition zone ions, and Fe IX-XVI, which are relatively brighter in the adjacent flare ribbons overlying strong vertical magnetic field. An electron density of 5×10^{10} cm^{-3} for the Fe XXIV emission region is deduced from the observational data, and the cooling rate is briefly discussed. (auth)

17996 EXTREME–ULTRAVIOLET OBSERVATIONS OF CORONAL HOLES: INITIAL RESULTS FROM SKYLAB. Huber, M.C.E.; Foukal, P.V.; Noyes, R.W.; Reeves, E.M.; Schmahl, E.J.; Timothy, J.G.; Vernazza, J.E.; Withbroe, G.L. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. Lett. 194: No. 2, L115-L118 (1 Dec 1974).

We compare the appearance and physical parameters of the solar chromosphere, transition zone, and corona in areas of coronal holes with that of quiet areas outside the hole. Measurements of the height of emission of various ions in a coronal hole appearing at the polar limb give a quantitative indication of the increased thickness of the transition zone underlying coronal holes. (auth)

17997 CORONAL STRUCTURE OVER THE ACTIVE REGION AFTER SOLAR FLARE. Nesmyanovich, A. T.; Dzyubenko, N. I.; Khomenko, Yu. A.; Popov, O. S. (Kiev State Univ.). Astrometriya Astrofiz.; No. 22, 42-53(1974). (In Russian).

The paper deals with a detailed study of the structure of the solar corona (observed on September 22, 1968) in the northwestern active region. The structure was apparently due to some active processes at the photosphere–chromosphere levels. The great coronal ray situated over the bright condensation, had a screw-like structure formed by the system of thin fast-expanding jets. Coronal porosity increased towards the solar surface. The existence of some "hierarchy" of the corona structure formations is supposed. Brightness distribution and electron concentration are presented. It follows from the flow continuity equation, that no ray jets were direct sources of the solar wind. The structural peculiarities of the ray are interpreted as a result of the unstable helical wave propagation along the ray caused by rotation of the sunspot magnetic field at the time of flare. (auth)

17998 ACTIVE REGIONS IN THE SOLAR WIND FROM COMET OBSERVATION DATA. II. Tarashchuk, V. P. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 22, 53-57(1974). (In Russian).

The paper deals with active zones in the solar wind. Two cases are considered: (1) when aberration velocities ω_m exceed the solar-wind velocity usually observed; (2) when an axis of the comet tail of Type I is going ahead the prolonged radius-vector (the deviation angle $\epsilon < 0$). The dependence ω_m and ϵ on heliographic latitude for different phases of the solar cycle is found. In the year of solar activity maxima the predominant part of the values ω_m falls into the region with b = 45–55° (r < 1 AU) and b = 30° (r > 1 AU) while during solar activity minima ω_m are observed at b = 5 to 15° (r > 1 AU), b = 70° and 44° (r < 1 AU). Most values of the angle $\epsilon < 0$ are observed at the latitudes b = 45° for maxima and b = 5 to 15° for minima of solar activity. The values of ω_m and $\epsilon > 0$ tend to show the 27-day recurrence. (auth)

17999 VELOCITY OF SOLAR WIND AT LOW HELIOGRAPHIC LATITUDES. Tarashchuk, V. P. (Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 22, 57-61(1974). (In Russian).

The solar-wind velocity can be obtained from the variations of the angles between the axes of comet tails of Type I and the prolonged radius-vector. The dependence of the velocity on the heliographic latitude within the zone 0 to 14° is studied. The regions in which the velocity increases and decreases are found. Displacement of the active zones during the 11-year cycle of the solar activity is revealed. (auth)

18000 EXPERIMENT TO STUDY ELECTRONS OF SOLAR ORIGIN BY THE PROGNOZ SATELLITES. Grigorov, N. L.; Kurt, V. G.; Logachev, Yu. I.; Lutsenko, V. M.; Likin, O. B.; Nikolaeva, N. S.; Pisarenko, N. F.; Savenko, I. A.; Svechnikov, N. Yu.; Shestopalov, I. P. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 59-65(1974).

Translated from Kosm. Issled.; 12: No. 1, 67-73(1974).

An experiment to study the energy spectrum, angular distribution, and time variations of streams of electrons with energies $E \geq 30$ keV is described; preliminary results also are given of the measurement of electron fluxes by the Prognoz satellites. Two groups of detectors for recording the electrons are described. In the first group, in order to separate the electrons from the protons, magnetic analysis is used and in the second group, the effect of backscattering of electrons from a substance with a high Z-number is used. (auth)

18001 MEASUREMENTS OF THE PROTON AND α COMPONENT OF PLASMA BY THE PROGNOZ SATELLITE DURING HIGH SOLAR ACTIVITY (AUGUST 1972). Temnyi, V. V.; Zertsalov, A. A.; Vaisberg, O. L.; Berezin, Yu. E. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 66-71(1974).

Translated from Kosm. Issled.; 12: No. 1, 74-79(1974).

During the period from August 3 to August 14, 1972, measurements were undertaken by the Prognoz satellite of the spectra of the solar wind protons and α particles. Measurements were obtained of the changes of temperature, concentration, and velocity of these components for the plasma resulting from the flare of August 2, at 0316h UT. Enrichment of this plasma by

$^4He^{++}$ ions was noted two hours after the arrival of the shock wave front. It is possible to discriminate the region of the pinched solar wind ahead of the plasma blob ejected by the flare. The magnitude of the slowing down of the plasma velocity from the flare of August, 1972 at 0316h UT was 0.79. Just as in the plasma from this flare, in the plasma from the flare of August 4, 1972 at 0621h and August 7, 1972 at 1509h, a decrease with time of the translational velocity of the plasma was observed. (auth)

Galaxies

Refer also to abstracts 17862, 17877, 17885, 17891, 17907, 17923, and 18057.

18002 NATURE OF THE SMALL DARK GLOBULES IN THE ROSETTE NEBULA. Herbig, G. H. (Univ. of California, Santa Cruz). Publ. Astron. Soc. Pac.; 86: No. 513, 604-608(Oct 1974).

The small dark globules seen against the nebulosity in the northwest quadrant of NGC 2237-2244 are shown on a 120-inch direct photograph to have an elongated, tear-drop form with the symmetry axes and sharper edges directed toward the central star cluster. This orientation is shared by the well-known elephant trunk structure, which in general lies farther from the center than these isolated dark spots. Examples of globules still connected with large dark masses by dust filaments are also present. It is suggested that these globules represent a late stage in the pinching-off and dissipation of elephant trunks as the central cavity of the H_{II} region expands into the peripheral dust clouds, and that these globules are not protostars. It is estimated that the age of a typical small isolated globule in this region of NGC 2237-2244 is of the order of 10^4 years. (auth)

18003 MASS OF THE COMA CLUSTER OF GALAXIES. Smith, H. Jr. (Univ. of South Florida, Gainesville). Publ. Astron. Soc. Pac.; 86: No. 513, 612-615(Oct 1974).

The mass of the Coma Cluster of galaxies is estimated by comparing it to calculated N-body systems and applying the virial theorem. The mass estimated by comparison with systems with two mass components is 1.4×10^{15} $M_{\odot}$. (auth)

18004 DIGICON PHOTOMETRY OF AN INTERGALACTIC BRIDGE. Beaver, E. A. (Univ. of California, San Diego); Harms, R. J.; Tifft, W. G.; Sargent, T. A. Publ. Astron. Soc. Pac.; 86: No. 513, 639-644(Oct 1974).

Surface brightness and color data are derived for two points in the bridge and tail structure of Arp 295. The best observed point has a surface brightness in V of 25.9 magnitudes per square arc second and $(B-V) = +1.00$ m. A point on the tail is brighter with the same color. (auth)

18005 RADIAL VELOCITY AND DISTANCE OF GR8. Hodge, P. W. (Harvard Coll. Observatory, Cambridge, MA). Publ. Astron. Soc. Pac.; 86: No. 513, 645-648(Oct 1974).

The dwarf irregular galaxy GR8 has a radial velocity, determined from optical and radio observations, of $+227 \pm 5$ km sec^{-1}. It contains two well-resolved H_{II} regions of low surface brightness. Its distance is estimated from six different but highly uncertain arguments, from which it is concluded that probably the best estimate at present is 1.0 ± 0.5 Mpc. This places it just inside the local group and implies that its size is 300 pc and its absolute magnitude is $M_V = -10.6$. (auth)

18006 RADIO EMISSION FROM SOME MARKARIAN GALAXIES AT 430 MHz. Tovmassian, H. M. (Byurakan Astrophysical Observatory, Erevan); Terzian, Y. Publ. Astron. Soc. Pac.; 86: No. 513, 649-651(Oct 1974).

Markarian galaxies have been observed with the 1000-foot radio telescope at Arecibo. Approximately 20% of the observed galaxies showed weak radio emission. For the detected galaxies their radio indices and radio luminosities are given. (auth)

18007 AU LEONIS: AN EXTRAGALACTIC OBJECT IN THE GENERAL CATALOGUE OF VARIABLE STARS. Bond, H. E. (Louisiana State Univ. Observatory, Baton Rouge); Green, R. F.; Huchra, J. P. Publ. Astron. Soc. Pac.; 86: No. 513, 668-669 (Oct 1974).

The object AU Leo, listed in the General Catalogue of Variable Stars as a U Geminorum-type variable, is actually a blue irregular galaxy. It has a sharp emission-line spectrum of high excitation, and a redshift of $+7545 \pm 40$ km sec^{-1}. In view of the difficulty in determining magnitudes of extended objects, there is little evidence for its variability. (auth)

18008 INFRARED OBSERVATIONS OF NEW COMETARY NEBULAE. Cohen, M. (Univ. of California, Berkeley). Publ. Astron. Soc. Pac.; 86: No. 513, 813-819(Oct 1974).

An infrared photometric survey of small nebulae selected from the Palomar Sky Survey prints reveals that long wavelength radiation (~ 10 μ) is only detected from those objects with "cometary" morphology. The structure of the nebulae and the infrared properties of their associated stars suggest that cometary nebulae are young stars surrounded by a disk-like distribution of dust, which may be viewed at various inclinations. (auth)

18009 STEPHAN QUINTET. Chamaraux, P. (Paris Observatory). Astronomie; 88: 115-140(Apr 1974). (In French).

The Stephan quintet is shown to be very closely related to two unsolved problems in extragalactic astronomy: the apparent instability of galactic clusters and the existence of abnormal redshifts. (FR)

18010 ELECTROSTATIC CHARGING AND FORMATION OF COMPOSITE INTERSTELLAR GRAINS. Fuerbacher, B.; Willis, R. F.; Fitton, B. (European Scientific Research Organization, Noordwijk, Netherlands). pp 415-426 of Photon and Particle Interactions with Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

The equilibrium potential is calculated for interstellar grains subjected to typical uv radiation fields and plasma parameters, using two different grain materials. For an environment typical of an H I region, the results show that the various components of interstellar grains in the multicomponent model may charge to potentials of opposite sign, thus favoring the formation of mixed composite grains due to Coulombic attraction. In H II regions, a three-shell model which defines the grain charge is presented, consisting of a sphere of positively charged grains around the central star bounded by a transition region, in which the two types of grains are oppositely charged. Here grain growth and the formation of mixed composite grains may take place. In the outer shell all grains are charged negative. Estimated radii of these zones are given for an exciting O5 type star. (auth)

18011 STUDY OF THE CHEMICAL COMPOSITION AND ENERGY SPECTRA OF GALACTIC COSMIC RAYS ON BOARD SATELLITES. Grigorov, N. L.; Volodichev, N. N.; Savenko, I. A.; Suslov, A. A. pp 126-137 of Izuchenie Kosmicheskikh Luchei na Iskusstvennykh Sputnikakh Zemli. Shtern, M. I. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

Measurements of primary cosmic-ray nuclear fluxes ($Z = 1, 2, 4, 6$, and 16) obtained with a Cherenkov spectrometer carried by the Proton 2 satellite are discussed. The measurements were made beyond the earth's shadow during 631 orbits during 1965. The averaged data show that the intensities measured exceed by a factor of 2 to 3 the intensities obtained by other investigators during the same period, using balloon-borne instruments. (IAA)

18012 DYING STARS AND REBORN DUST. Salpeter, E.E. (Cornell University, Ithaca, New York 14850). Rev. Mod. Phys. 46: No. 3, 433-436 (July 1974).

A brief review is given on the theories to explain the observed chemical composition and abundance of interstellar dust grains. In particular, the effect of dying stars on producing and replenishing the grains is considered. (AIP)

18013 ON THE INTERSTELLAR ABUNDANCE OF THE CH^+ RADICAL. Brzozowski, J.; Elander, N.; Erman, P.; Lyyra, M. (Research Institute for Physics, Stockholm, Sweden). Astrophys. J. 193: No. 3, 741-745 (1 Nov 1974).

The lifetimes of the $^1\Pi$, $^1\Delta$, and $^3\Sigma$ states in CH^+ have been directly measured at high resolution using the high-frequency deflection technique. In particular, eight studied bands of the $A\ ^1\Pi - X\ ^1\Sigma$ system yield considerably longer lifetime than those obtained earlier. The new f-values are more in agreement with recent theoretical calculations and demand a corresponding increase in the estimate of the interstellar CH^+ abundance. (auth)

18014 ON DENSITY WAVES IN GALAXIES. I. SOURCE TERMS AND ACTION CONSERVATION. Mark, J.W. (Massachusetts Institute of Technology). Astrophys. J. 193: No. 3, 539-559 (1 Nov 1974).

Generalized versions of the Lin–Shu dispersion relation and the Toomre–Shu conservation principle of wave action have been derived. These are valid even in the neighborhood of all the Linblad resonances. Because of the finite radial epicyclic excursions of the resonant stars, each resonance influences a region of the order of one or two epicyclic distances. For our Galaxy, these are annular regions each several kiloparsecs in width. Our generalized dispersion relation gives finite wavenumbers throughout the resonance regions. Provided that there is not also a very rapid temperal decay in amplitude, both leading and trailing short waves are found to decay spatially in the direction of their respective group propagation. This decay process can be described physically in terms of the detailed balance of energy and angular momentum through a generalized conservation principle of wave action.

This principle involves a modified form of the flux term. In addition, an important new feature is that it also includes source terms which always result in the damping of the waves at the Lindblad resonances. In particular, we have a detailed source density term of angular momentum which can be compared with the integrated (total) source obtained by Lynden—Bell and Kalnajs. Under certain approximations, we have also rederived this source density by their methods and have shown that it agrees with our formula. Other implications of this theory include the fact that the surface mass density of the spiral wave in our Galaxy has a peak which correlates well with the peak of ionized hydrogen density. This correlation, first suggested by Lin and Feldman, is now found to be a possible test of wave pattern speed for some galaxies. Our present calculation also elucidates the different behavior of leading and trailing spirals. Within certain conditions, trailing waves are preferred. (auth)

18015 THE STRUCTURE AND STABILITY OF SHOCK WAVES IN A MULTIPHASE INTERSTELLAR MEDIUM. Mufson, S.L. (The University of Chicago). Astrophys. J. 193: No. 3, 561-574 (1 Nov 1974).

The effect of shock waves on a parcel of gas initially in one phase of a multiphase interstellar medium is studied. Here the multiplicity of phases is attributed to a constant flux of low—energy cosmic rays which heats the gas. In this investigation shocks with Mach numbers between 1.5 and 6.0 are surveyed. It is found that if the shock is sufficiently strong, then the gas initially in the hot phase will undergo a phase transition and move to the cold phase; otherwise the gas will remain in the hot phase. A shock will always drive gas in the unstable phase to the cold phase. However, a shock in the cold phase doe not instigate a phase change. The stability of the gas in the nonequilibrium conditions behind the shock was investigated in the limit of short perturbation wavelengths. The results show that the gas passes through a zone of thermal instability if the shock instigates a phase change. The study of the stability of the overall flow in the limit that the perturbation wavelengths are long shows that the gas is stable whether or not the shock instigates a phase change. Several numerical examples demonstrate that interstellar shocks play an important role in the conversion of intercloud material to cloud material in the Galaxy. (auth)

18016 SMALL SILICON MOLECULES: POSSIBLE SOURCES OF THE UNIDENTIFIED MOLECULAR LINES U81.5, U86.2, U89.2, AND U90.7. Lovas, F.J. (Optical Physics Division, National Bureau of Standards, Washington, D.C.). Astrophys. J. 193: No. 1, 265-272 (1 Oct 1974).

Several small silicon molecules are considered as possible sources for the unidentified molecular lines: U81.5, U86.2, U89.2, and U90.7. The best spectroscopic and structural data available have been utilized to predict the lowest rotational transitions for SiO^+, SiN, SiC, HSiN, and for vibrationally excited SiO. Transitions from each of these molecules are predicted to occur close to one or more of these unidentified molecular lines. Rotational transitions which could aid the confirmation of each of the suggested assignments are also presented. In all cases, an effort has been made to estimate the uncertainties for the predicted transitions. (auth)

18017 DARK NEBULAE IN THE MAGELLANIC CLOUDS. van den Bergh, S. (David Dunlap Observatory, University of Toronto, Richmond Hill, Ontario, Canada). Astrophys. J. 193: No. 1, 63-64 (1 Oct 1974).

Curtis Schmidt plates of the Magellanic Clouds show that both the LMC and the SMC contain dark nebulae. The dark clouds in the Large Cloud are, however, much more prominent than are those in the Small Cloud. It is suggested that this difference is due to the fact that the SMC gas has a lower heavy—element content than does the gas in the LMC. (auth)

18018 FURTHER OBSERVATIONS AT THE INTERSTELLAR DEUTERIUM FREQUENCY. Pasachoff, J.M. (Williams College—Hopkins Observatory, Williamstown, Massachusetts); Cesarsky, D.A. Astrophys. J. 193: No. 1, 65-67 (1 Oct 1974).

We repeated our observations of the galactic center in the vicinity of the deuterium ground—state hyperfine transition at 327 MHz. In this year's observations, we tried to use a wider bandwidth better to match the possible line shape while increasing the baseline. Not all the baseline appears interference free, and our overall noise levels after 40 hours on source is comparable to last year's. The absorption dip that would correspond to a deuterium line at $\nu_{LSR} = -3.7$ km s^{-1} again appears, with a comparable, statistically insignificant strength. Merging the data from both years gives an upper limit of 3.5×10^{-4} and a range, if the absorption is the deuterium line, from 3.5×10^{-4} to 2×10^{-5}. This implies cosmic densities insufficient to close the Universe. (auth)

18019 MODEL CALCULATIONS FOR DIFFUSE MOLECULAR CLOUDS. Glassgold, A.E.; Langer, W.D. (New York University). Astrophys. J. 193: No. 1, 73-91 (1 Oct 1974).

A steady—state isobaric cloud model is developed. The pressure, thermal, electrical, and chemical balance equations are solved simultaneously with a simple one—dimensional approximation to the equation of radiative transfer appropriate to diffuse clouds. Cooling is mainly by C II fine—structure transitions, and a variety of heating mechanisms are considered. Particular attention is given to the abundance variation of H_2 using an extension of the work of Hollenbach, Werner, and Salpeter. Inhomogeneous density distributions are obtained because of the attenuation of the interstellar ultraviolet field and the conversion from atomic to molecular hydrogen. The effects of changing the model parameters are described, and the applicability of the model to OAO—3 observations is discussed. Good qualitative agreement with the fractional H_2 abundance determinations has been obtained. The observed kinetic temperatures near 80°K can also be achieved by grain photoelectron heating. The problem of the electron density is solved taking special account of the various hydrogen ions as well as heavier ones. The roles of C I and C II column density determinations are also emphasized. (auth)

18020 ON THE ULTRAVIOLET RADIATION IN THE GALAXY. Terzian, Y. (Department of Physics, University of Montreal). Astrophys. J. 193: No. 1, 93-95 (1 Oct 1974).

The ionizing radiation from the O5—B1 early—type stars in our Galaxy is discussed and the flux of this radiation is estimated to be $\sim 7.5 \times 10^{52}$ photons s^{-1}. Adopting the results of Cahn and Kaler on the density and number of the optically thin planetary nebulae in our Galaxy, it is shown that the total ultraviolet radiation which escapes from these nebulae is very significant, and it is of the order of that produced by the early—type stars. It is proposed that this radiation is an important source of ionization of the diffuse interstellar medium, and of heat supply to the interstellar grains. This radiation is very important particularly in the regions of the galactic center. (auth)

18021 ON QSO AND SEYFERT GALAXY LINE—EMISSION MODELS. MacAlpine, G.M. (University of Michigan, Ann Arbor). Astrophys. J. 193: No. 1, 37-42 (1 Oct 1974).

Utilizing detailed photoionization model calculations for the physical conditions in QSO and Seyfert galaxy line—emitting regions, the significance of Auger electron removal following ionization from a filled K—shell is examined, and the validity of the "on—the—spot" absorption approximation for treating diffuse ionizing radiation is also discussed. It is suggested that the observed strengths, profiles, and variability of emission lines may be accounted for by a composite model in which the broad permitted lines result largely from streaming suprathermal particles, while the narrower forbidden lines originate primarily in a thin gas photoionized by radiation from a high—temperature shocked region. (auth)

18022 EMPIRICAL PROPERTIES OF THE MASS DISCREPANCY IN GROUPS AND CLUSTERS OF GALAXIES. III. THE PAGE AND JENNER SAMPLES OF CLOSE DOUBLE GALAXIES. Rood, H.J. (Astronomy Department, Michigan State University, East Lansing). Astrophys. J. 193: No. 1, 1-13 (1 Oct 1974).

Page's sample of double galaxies shows a strong correlation between the ratio of "best guess" virial mass to luminous mass (M_{vt}/M) and virial velocity dispersion (V). M_{vt}/M is not significantly correlated with virial radius R, nor is V with R. A simple analysis indicates that these results are not produced by projection effects. The correlation between M_{vt}/M and V applies also to Jenner's sample of double supergiant galaxies, and to double systems in which one component is the dominant galaxy of a "solar—system—type" group. (auth)

18023 CONCERNING TWO FORCES HYPOTHESIZED TO RESOLVE THE MASS DISCREPANCY OF GALAXY CLUSTERS. Rood, H.J. (Astronomy Department, Michigan State University, East Lansing). Astrophys. J. 193: No. 1, 15-18 (1 Oct 1974).

A force with slower falloff than Newtonian gravitation cannot explain the observed correlation between cluster mass—ratio (Newtonian virial mass/luminous mass) and velocity dispersion. For clusters with mass ratios of order 10—100, a cosmological force with negative cosmological constant conflicts with the observed large range of ratios of cluster radius to velocity dispersion, and with the observed weak or negligible dependence of velocity dispersion on radius. (auth)

18024 TIDAL EFFECTS AS CRITERIA FOR MEMBERSHIP IN SMALL GROUPS OF GALAXIES: APPLICATION TO VV 166. Kormendy, J.; Sargent, W.L.W. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 193: No. 1, 19-25 (1 Oct 1974).

Brightness distributions of galaxies in clusters are distorted by gravitational tidal forces due to their neighbors. In particular, the brightness profiles are truncated at radii determined by the minimum separation from perturbing objects. The presence or absence of these effects is evidence for or against cluster membership of galaxies with discrepant redshifts. The galaxy group VV 166 (the NGC 70 group) is a compact group of 8 galaxies, one of which, NGC 68, has a velocity 1000 km s^{-1} smaller than the average. New velocities are presented for seven objects; the best mean values yield a velocity dispersion of 404 km s^{-1} if NGC 68 is included, or 240 km s^{-1} if it is omitted. These imply mass—to—light ratios M/L of 144 and 70 in solar units

($H_0 = 75$ km s^{-1} Mpc^{-1}). When the galaxies are weighted in the averaging according to their assumed relative masses, the values become 186 and 51, respectively. A brightness profile has been measured for NGC 68. This reveals no departure from a de Vaucouleurs relation to 70", or ~30 kpc, radius, which equals the galaxy's separation from its neighbors. The absence of tidal distortion, and the dynamical implausibility of a group whose most massive member has the most loosely bound orbit, makes it unlikely that NGC 68 is a member of VV 166. Then the implied $M/L \simeq 51$ is reasonable for a group of spirals and ellipticals. (auth)

18025 OBSERVATIONS OF INFRARED POLARIZATION IN THE ORION NEBULA. Dyck, H.M.; Beichman, C.A. (Institute for Astronomy, University of Hawaii). Astrophys. J. 194: No. 1, 57-64 (15 Nov 1974).

We present new infrared linear–polarization observations of the Becklin–Neugebauer and Kleinmann–Low objects in the Orion Nebula. We have confirmed that the amount of polarization is correlated with the silicate feature but cannot confirm the wavelength dependence of the polarization angle θ previously reported. Instead, we find that θ does not vary with wavelength from 3.5 to 12.6 μ. We have also observed the polarization of various portions of the Kleinmann–Low nebula at 11 μ and find no spatial dependence of θ. Using a simple model we show that the observations can be explained satisfactorily if the polarization arises in a cold medium of aligned particles. We argue that the alignment is produced by a magnetic field of strength 7×10^{-3} gauss by the Davis–Greenstein mechanism. Further, the field must be reasonably uniform over approximately 0.1 pc in the Kleinmann–Low nebula. (auth)

18026 OPTICAL AND INFRARED OBSERVATIONS OF THE JET OF M87. Kinman, T.D.; Grasdalen, G.L. (Kitt Peak National Observatory); Rieke, G.H. Astrophys. J. Lett. 194: No. 1, L1-L4 (15 Nov 1974).

New photoelectric UBV observations of the A and B components of the jet of M87 are consistent with the radiation from a power–law spectrum with exponent -1.7 ± 0.2. The B magnitude found was similar to that in other recent determinations. The effect of an error in the correction for the background light of the galaxy is discussed for the present and previous observations; it can be very large. Upper limits to the infrared flux for the same part of the jet are given for 1.55, 3.5, and 10.6 μ, and show that the spectrum must be flatter at these wavelengths than in the optical. The present evidence is hard to reconcile with a spectrum that monotonically increases in slope with increasing frequency from about -0.55 at a few GHz to its value in the optical. (auth)

18027 DETECTION OF NEW CELESTIAL OBJECTS AT FAR–INFRARED WAVELENGTHS. Friedlander, M.W.; Goebel, J.H.; Joseph, R.D. (Laboratory for Space Physics, Department of Physics, Washington University). Astrophys. J. Lett. 194: No. 1, L5-L8 (15 Nov 1974).

During a high–altitude balloon flight, sources of far–infrared radiation have been detected with apparent fluxes $\sim 3 \times 10^{-12}$ W cm^{-2} in the spectral band 50–500 μ. While the sources are not uniquely identifiable with any well–known class of celestial objects, two associations should be noted. Many of the objects lie close to local stars; there is also a tendency to cluster around the ecliptic plane. Alternatively, a new class of celestial objects may have been observed. (auth)

18028 Λ–TYPE DOUBLING IN THE CD MOLECULE. Hammersley, R.E.; Richards, W.G. (Physical Chemistry Laboratory, University of Oxford, England). Astrophys. J. Lett. 194: No. 1, L61-L61 (15 Nov 1974).

An ab initio calculation of the Λ–type doubling of the rotational ground state of the CD molecule has been performed. The predicted splitting is 1241 MHz. (auth)

18029 OBSERVATIONS OF H_2CO IN THE DIRECTION OF CASSIOPEIA A. Troland, T.H.; Heiles, C. (Department of Astronomy, University of California, Berkeley). Astrophys. J. 194: No. 1, 43-48 (15 Nov 1974).

We report on 6–cm H_2CO profiles obtained at and near the position of Cas A. The gas is found to have spatial structure on a scale of 4' or less. This structure shows some similarities and some differences with H I structure across the source. H_2CO absorption lines have been detected at three positions near Cas A. The data suggest a lower limit of 2.4°K for the excitation temperature; however, this value is highly uncertain because of spatial structure of the gas. We have tried to separate thermal and turbulent velocity widths in the two Local Arm absorption features which appear at about the same velocities in H_2CO, OH, and H I. Inconsistent results are derived for one of these components, which casts doubt on the validity of this procedure in any case. (auth)

18030 A SEARCH FOR INTERSTELLAR NITROXYL (HNO). Fourikis, N.; Sinclair, M.W. (Division of Radiophysics, CSIRO, Sydney, Australia); Brown, R.D.; Crofts, J.G.; Godfrey, P.D. Astrophys. J. 194: No. 1, 41-42 (15 Nov 1974).

An unsuccessful search for the $1_{10}-1_{11}$ transition of nitroxyl HNO in the direction of Sgr B2, Sgr A, W51, and RCW 38 is described. (auth)

18031 EMPIRICAL PROPERTIES OF THE MASS DISCREPANCY IN GROUPS AND CLUSTERS OF GALAXIES. V. NINE SAMPLES. Rood, H.J. (Department of Astronomy and Astrophysics, Michigan State University, East Lansing). Astrophys. J. 194: No. 1, 27-35 (15 Nov 1974).

The present paper analyzes (i) a sample of 12 rich clusters and (ii) a sample of five superclusters. Results from the entire series of five papers are summarized and discussed. It is concluded that the correlation between the ratio of virial mass to luminous mass (M_{vt}/M) and virial velocity dispersion (V), in which M_{vt}/M increases by a factor of about 100 as V increases from 100 km s^{-1} to 1000 km s^{-1}, is observed for the following types of systems of galaxies: isolated classical double galaxies, classical double galaxies with one component the most luminous massive member of a "solar system–type" loose group, isolated double compact galaxies, double supergiant galaxies in rich clusters, compact groups, loose groups, rich clusters, and superclusters(:). M_{vt}/M is correlated with virial radius (R) for loose groups, but not for the other types of systems. V is not significantly correlated with R. The median value of M_{vt}/M at a given V depends on type of system, and on dominant morphological type (spiral, mixed, or elliptical) of the galaxies in a system. (auth)

18032 THE SYSTEMATIC PROPERTIES OF CLUSTERS OF GALAXIES. I. PHOTOMETRY OF 15 CLUSTERS. Oemler, A. Jr. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 194: No. 1, 1-19 (15 Nov 1974).

Fifteen rich clusters of galaxies have been studied using a new automatic method for finding and photometering galaxies on photographic plates. It was found that their properties are such that they may be divided into three groups. Spiral–rich clusters have compositions similar to that of the field, irregular mass distributions of low density and no central concentration, and show no signs of segregation of members according to mass or morphological type. Clusters with cD galaxies are rich in ellipticals, have smooth, spherical mass distributions of high density and central concentration, have a strong deficiency of spirals in the core, and show a considerable tendency toward energy equipartition. Spiral–poor clusters, which are dominated by SO galaxies, also show segregation by mass and morphological type, but are not as smooth, dense, or centrally condensed as the cD clusters. The outer envelopes of all clusters have a projected density gradient of slope near 3.0. All clusters show a local minimum in the radial density distribution, the effect being strongest in the cD clusters. The mean density of clusters of all types is independent of mass. The luminosity functions of all clusters are similar, with a small dispersion in absolute magnitude. Arguments are presented that spiral–poor clusters represent a later evolutionary state of spiral–rich clusters but that cD clusters, while the most evolved, are intrinsically different. (auth)

18033 EMPIRICAL PROPERTIES OF THE MASS DISCREPANCY IN GROUPS AND CLUSTERS OF GALAXIES. IV. DOUBLE COMPACT GALAXIES. Chincarini, G.L. (McDonald Observatory, University of Texas, Austin); Rood, H.J. Astrophys. J. 194: No. 1, 21-26 (15 Nov 1974).

For a sample of 24 double compact galaxies, line–of–sight velocities given by Sargent and by Chincarini and Rood, and magnitudes given by Zwicky, are used to estimate average dynamical mass, ratio of average dynamical mass to average absolute luminosity, and ratios of "best guess" virial mass to luminous mass M_{vt}/M, virial velocity dispersions V, and virial radii R. It is found that M_{vt}/M is correlated with V, but not with R. V is not significantly correlated with R. (auth)

18034 EIGHTEEN POSSIBLE GALAXIES IN PUPPIS. Fitz-Gerald, M. P. (Ruhr-Univ., Bochum, Ger.). Astron. Astrophys.; 31: No. 4, 467-470(Apr 1974).

Eighteen possible galaxies are identified within 2.5° of the galactic plane in a region in Puppis at $l = 245°$ and $b = 0°$. These lie in the galactic plane and slightly to the north of it. None were found to the south, indicating that the absorption plane lies below galactic latitude zero. A rough estimate of the maximum photographic absorption in the direction of the galaxies is 4.5^m. This leads to an approximate upper limit to $R = A_v/E_{B-V} \leq 6.5$. (auth)

18035 POTTASCH'S INTERPRETATION OF THE INTERSTELLAR Na I/Ca II RATIO. White, R. E. (Goddard Space Flight Center, New York). Astron. Astrophys.; 31: No. 4, 459-460 (Apr 1974).

The interpretation of the interstellar Na I/Ca II ratio given by Pottasch (1972b) leads to the prediction of Ca I absorption in conflict with observation. (auth)

18036 POSSIBLE VARIATION IN THE RATE OF PASSAGE OF TIME. Barker, K. D. Astron. Astrophys.; 31: No. 4, 461(Apr 1974).

It is suggested that an acceleration of the rate of passage of time may be responsible for the galactic redshifts. The mechanism is an acceleration of atomic frequencies in the laboratory whilst signals from distant sources are in transit. This is an extension of the work of Milne (1948), who proposed an accelerating time-scale for certain classes of phenomena only. Several experimental tests are possible, but difficult. In particular, reflection of a radiation from a distant fixed reflector should produce a differential frequency shift, and the use of a communication satellite in a distant Earth orbit is suggested. (auth)

18037 RADIO OBSERVATIONS OF NORMAL GALAXIES. Le Squeren, A. M.; Crovisier, J. (Observatory, Meudon, France). Astron. Astrophys.; 31: No. 4, 447-450(Apr 1974).

Observations of 15 spiral and irregular galaxies at 4850 MHz are described. The radio spectra between 21 cm and 6 cm of 18 disk components and 9 nuclear components are compared and discussed. The spectral index of the radio disk component appears to be steeper than that of the radio nucleus. Implications for the origin of relativistic electrons responsible for the synchrotron radio radiation are discussed. (auth)

18038 OSCILLATOR STRENGTHS FOR IONIZED IRON AND MANGANESE. de Boer, K. S.; Morton, D. C.; Pottasch, S. R.; York, D. G. (Princeton Univ., NJ). Astron. Astrophys.; 31: No. 4, 405-408(Apr 1974).

The observed strengths of interstellar absorption lines of Fe II and Mn II in the spectra of α Vir, β Cen, π Sco, and ζ Oph along with laboratory f values of some of these lines between 2343 and 2606 Å were used to determine curves of growth for these ions and the f-values of 10 lines of Fe II and 3 lines of Mn II between 1055 and 1261 Å. The Fe and Mn abundances are derived. (auth)

18039 REDSHIFTS OF PARENT GALAXIES OF SUPERNOVAE. Barbon, R.; Capaccioli, M. (Univ., Padua). Astron. Astrophys.; 35: No. 1, 151-152(Sep 1974).

Redshifts for nine parent galaxies of supernovae are presented. (auth)

18040 DISTRIBUTION OF CLUSTERS OF GALAXIES AS RELATED TO GALACTIC ABSORPTION. Holmberg, E. B. (Uppsala Univ.). Astron. Astrophys.; 35: No. 1, 121-141(Sep 1974).

A detailed statistical investigation of the space distribution of the galaxy clusters listed in the catalogs by Zwicky and collaborators gives the result that the projected distribution very closely approaches a uniform one. Previous investigations have in many cases led to erroneous conclusions, since sufficient attention has not been paid to the disturbances caused by local variations in the galactic absorption. In order to obtain realistic results, it has seemed necessary to combine the analysis of the cluster distribution with an analysis of the absorption. The procedure followed has been to start from the assumption of a random cluster distribution and to critically examine the resulting variations in galactic absorption. The local absorption deviations from the mean cosecant law are reproduced in maps. The absorption appears to be heavier than normal in the region of the galactic center, and lighter than normal in the anticenter direction. The dispersion in the absorption appears to be proportional to the square root of the cosecant of the latitude, which may be interpreted as indicating a Poisson distribution for the galactic dust clouds. The most reliable proof for the reality of the derived absorption deviations is obtained from comparisons with the colors of galaxies (as determined by Holmberg and by de Vaucouleurs), and with the colors of RR Lyrae stars. The comparisons show a very good agreement, statistically speaking, between color excess and absorption deviation. The random distribution of the galaxy clusters has thus been proved in an indirect way. The galactic absorption has been calibrated by means of the color excesses observed for galaxies, RR Lyrae stars, globular clusters, and the brightest members of galaxy clusters. Nine independent determinations give a mean color excess at the galactic poles of $E(B-V) = 0.054 \pm .004$ (m.e.). The disagreement between this result and the color excesses obtained in some recent investigations for stars in the polar caps is discussed in some detail. Comparisons with the lists of individual galaxies given in the Zwicky catalogs, and with the Lick Observatory counts, indicate rather pronounced grouping tendencies among the galaxies. The local variations in galactic absorption are only to a limited extent reflected in the observed distribution of the galaxies. (auth)

18041 FREQUENCY DEPENDENCE OF THE CARBON RECOMBINATION LINE. Hoang-Binh, D. (Observatory, Meudon, France); Walmsley, C. M. Astron. Astrophys.; 35: No. 1, 49-56 (Sep 1974).

Current radio observations of the carbon line clouds are used to derive their physical parameters. b_n factors are calculated for a low-temperature gas and the results are compared with those of previous authors. A comparison is then made of the line intensities observed as a function of frequency with those expected on the basis of simple theoretical models. It is found that for the three most studied sources, the best fit to the observations is obtained if the emission is mainly due to spontaneous transitions. An electron density of 10 cm^{-3} and a kinetic temperature of 100 K are the approximate parameters of the best fitting models. (auth)

18042 GALACTIC EVOLUTION. II. Why is the Reddening Law in Our Galaxy Unique? A Working Hypothesis. Pecker, J. C. (College de France, Paris). Astron. Astrophys.; 35: No. 1, 7-12(Sep 1974). (In French).

From the schematical description of Paper I (Pecker, 1972b), it can be shown that dust grains of size larger than $3 \cdot 10^{-6}$ cm are attracted by the Galaxy, smaller size dust grains being repulsed, in the present state of the Galaxy. However, the grains of size larger than $3 \cdot 10^{-5}$ are attracted by MS stars colder than A 5 (such stars contain more than 99% of the mass of the stellar component of the Galaxy) whenever grains smaller than that size, generally speaking, are repulsed. Hence the only grains that can stay for a relatively long time in the Galaxy are those of roughly that size range (except possibly for smaller grains which can be collected equatorially by the Galaxy). This fact explains roughly why the reddening law within the Galaxy has always been found to be nearly the same, except in some selected regions, where it reflects essentially the circumstellar distribution of grains and not the interstellar distribution. (auth)

18043 CONSTRUCTION OF THE STELLAR SYSTEM MODELS ADMITTING THE THIRD QUADRATIC INTEGRAL MOTION. Rodionov, V. I. Vestn. Leningrad. Univ., Mat., Mekh., Astron.; No. 3, 142-148(Jul 1974). (In Russian).

The methods of the direct finding of the function which formed the potential in the third quadratic integral theory are discussed. The modified version of finding this function for the galaxy is suggested. The new property of such potential is found. (auth)

18044 EFFECT OF UV STARS ON THE INTERSTELLAR MEDIUM. III. Computer Simulations of an Interstellar Medium With uv Stars. Castle, K. G.; Hills, J. G. (Univ. of Michigan, Ann Arbor). Astron. Astrophys.; 30: No. 3, 455-464(Feb 1974).

The effect of hot prewhite dwarfs (uv stars) on the interstellar medium (IM) was investigated through computer simulations. In the first series of simulations the uv stars were introduced at random into an IM of uniform density. The structure of the IM resulting from the overlap of the Strömgren spheres produced by the uv stars was studied by means of computer-generated plots showing two-dimensional slices of the IM. The second series of computer simulations allowed for the decrease in the space density of the uv stars and in the density of the gas in the IM as a function of height above the galactic plane. This fall off in density was found to have a negligible effect on the properties of the IM in the galactic plane due to the radius of the H II regions near the plane being much smaller than the density scale heights of either the gas or the uv stars. (WDM)

18045 CLASS OF DISK-LIKE MODELS FOR SELF-GRAVITATING STELLAR SYSTEMS. Miyamoto, M. (Astronomisches Rechen-Institut, Heidelberg). Astron. Astrophys.; 30: No. 3, 441-454(Feb 1974).

A construction scheme is proposed for disk-like models of self-gravitating steady-state stellar systems by using Fricke's (1952) type of the expansion for the velocity distribution function f(E,J) with respect to the energy integral E and the angular momentum integral J. The distribution function is analyzed by decomposing into three parts such as $f(E,J) = f_1(E) + f_2(E,J^2) + f_3(E,J)$. In order to avoid negative-valued f(E,J), it is assumed that a given density, the gravitational potential and the partial density, which is derived from $f_1(E)$ only, are monotonically decreasing with the distance from the center, and the coefficients of all the terms in $f_2(E,J^2)$ and $f_3(E,J)$ are positive. Properties of each expansion term in $f_2(E,J^2)$ and the corresponding partial density are investigated; (1) each term in $f_2(E,J^2)$ attains two maxima, located symmetrically in the velocity space, at an azimuthal velocity smaller than $2^{-\frac{1}{2}}$ times the escape velocity, (2) the equi-distribution curves near the two maximum points are approximately ellipses, (3) the axial ratio of the ellipses coincides with the well-known relation between the velocity dispersions and the Oort constants, (4) the skewness of the velocity distribution is indicated by an ellipse with its center at the origin of the velocity space, (5) in a limit of infinitely large exponents of E and J, each term tends to a δ-function with two peaks located symmetrically in the velocity space, (6) the corresponding partial density has one maximum, if the circular velocity of the disk is monotonically increasing with the distance from the center and is smaller than $2^{-\frac{1}{2}}$ times the escape velocity. Self-consistent models are possible in the whole range from an extremely "cold" state to an extremely "hot" state of the disk. (auth)

18046 NEUTRAL HYDROGEN, SPIRAL STRUCTURE, AND DENSITY WAVES IN M 31. Guibert, J. (Observatoire de Meudon, France). Astron. Astrophys.; 30: No. 3, 353-370(Feb 1974).

The 21 cm line observations of M 31 made at Nançay indicate that the neutral hydrogen is confined within the Holmberg dimensions of the galaxy. The large scale hydrogen distribution presents a ring-shaped structure; the density in the central depression may be as low as 8% of the maximum surface density. A well defined spiral structure is superimposed on this large scale distribution, most of the H I arms being in good agreement with the optical arms. The density wave theory has been applied to the region of the N.F. semi-major axis situated 10 kpc from the center, where the gas surface density is about 3% of the stellar mass surface density. Using the dispersion relation proposed by Lin and Shu, and the observed arm spacing (4 kpc) of the spiral structure, the angular velocity of the spiral pattern is found to be 11 km s^{-1} kpc^{-1}. Thus, the density wave pattern performs a complete revolution every $5.5 \cdot 10^8$ years. As predicted by the theory, this pattern speed is in agreement with the circular velocity of the outermost H II region as measured by Rubin and Ford. Despite the low gas density, the contribution of neutral hydrogen to the spiral gravitational potential reaches 30% of the contribution of disk population II stars. This is due to the high dispersion velocities of these stars for which the computed arm-inter arm contrast is thus one tenth of the observed contrast in gas—or young stars—spiral arms. (auth)

18047 FINE–SCALE STRUCTURE OF A COLD HYDROGEN LAYER. Baker, P.L. (Radio Astronomy Branch, Laboratory for Extraterrestrial Physics, Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. Lett. 194: No. 2, L109-L110 (1 Dec 1974).

Neutral–hydrogen absorption–line interferometer observations are reported for five continuum radio sources situated behind an extensive layer of cold interstellar H I gas. In contrast to low–spatial–resolution emission–line observations reported earlier which show the large–scale uniformity of the layer, the high–spatial–resolution absorption–line observations reveal variations in the velocity and density within the layer. The new results together with the old indicate the apparent coexistence of a large–scale mechanism for triggering the formation of cold hydrogen and an instability mechanism leading to small–scale irregularities. (auth)

18048 RADIATIVE TRAPPING AND POPULATION INVERSIONS OF THE SiO MASERS. Kwan, J. (Institute for Advanced Study); Scoville, N. Astrophys. J. Lett. 194: No. 2, L97-L101 (1 Dec 1974).

Radiative trapping in the $v=0\rightarrow1$ vibrational transitions decreases the rate of de–excitation of a $v=1$ level as its rotational quantum number increases. This effect readily leads to population inversions of the $v=1$ rotational transitions if population is transferred from $v=0$ into $v=1$ by collisions or by an indirect radiative route, as, for example, through absorptions from $v=0$ into $v=2$ and the subsequent spontaneous cascade from $v=2$ to $v=1$. Numerical calculations which model the SiO masers discovered toward stars give photon emission rates in the $J=1\rightarrow0$, $J=2\rightarrow1$, and $J=3\rightarrow2$ transitions which are comparable and substantial, $\sim3\times10^{43}$ s^{-1}. (auth)

18049 PRECISION OF PHOTOMETRIC CATALOGUE IN GREAT ORION NEBULA. Sincheskul, V. N. (Poltava Gravimetric Observatory, USSR). Astrometriya Astrofiz.; No. 22, 75-78(1974). (In Russian).

Information is given on precision of the photometric catalog of the magnitudes V and colors B–V and U–B in the Great Orion Nebula. The photographic magnitudes are compared with the photoelectric ones. (auth)

18050 INTERSTELLAR ABSORPTION IN THE REGION OF GREAT ORION NEBULA. Sincheskul, V. N. (Poltava Gravimetric Observatory, USSR). Astrometriya Astrofiz.; No. 22, 75-78(1974). (In Russian).

Interstellar absorption was investigated in the area of 9 square degrees around Great Orion Nebula by the method of plotting the diagrams E_{B-V}, $V-M_V$. The total visual absorption A_V reaches 4M if R = 5.0M. The distance to Orion was determined as 500 ps. (auth)

Cosmology

18051 (CONF-740522-, pp 675-679) ASTROPHYSICS AND ELEMENTARY PARTICLE PHYSICS. Ruffini, R. (Princeton Univ., NJ). 1974.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

In proceedings of the IXth international conference on high energy accelerators.

Recent developments of relativistic astrophysics allow the observation of regimes in which all existing field theories have never been tested. In the description of these regimes, unreachable in any experiment performed in a laboratory on the Earth, our current knowledge of electrodynamics or elementary particle physics has to be extrapolated by many orders of magnitude. For the first time, we are able to observe phenomena in which a fully relativistic treatment of gravitational interactions is mandatory. (auth)

18052 GRAVITATIONAL WAVE DETECTION AT LOW TEMPERATURES. Hamilton, W. O.; Pipes, P. B.; Nayar, P. S. (Louisiana State Univ., Baton Rouge). pp 555-558 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

The gravitational wave detector at the NASA Mississippi Test Facility is described. The gravity wave antenna consists of an aluminum bar 10 ft long and 3 ft in diameter weighing approximately 12,000 lb. The aluminium bar will be coated with a high-field superconductor and will be supported on a magnetic field created by pancake coils lying in the surrounding shell. The shell will be cooled by a dilution refrigerator. The motion of the bar will be detected by a superconducting accelerometer which is being developed at LSU. (WHK)

18053 LOW-TEMPERATURE GRAVITY WAVE DETECTOR. Opfer, J. E.; Boughn, S. P.; Fairbank, W. M.; McAshan, M. S.; Paik, H. J.; Taber, R. C. (Stanford Univ., CA). pp 559-562 of Low Temperature Physics: LT 13 Vol. 4. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (Eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P4).

A program to develop and build gravitational radiation detectors which can be cooled to extremely low temperatures is described. Cooling the detectors, which utilize massive aluminum bars as antennas, improves the sensitivity of detection by reducing thermal noise in the antennas and by allowing the use of low-noise superconducting electronics. In addition, a superconducting system can be used to support the antennas to reduce vibration-induced noise. Because cooling a detector to liquid helium temperatures already gives substantial improvement over performance at room temperature, a prototype detector is being constructed to operate at 1°K. This prototype detector will be a sensitive gravity wave detector as well as an aid in the development of detectors operating at much lower temperatures. (WHK)

18054 POSSIBLE INTERPRETATION FOR ANOMALOUS RED SHIFTS NEAR THE SUN USING THE PHOTON WAVE MECHANICS. Moles, M.; Vigier, J. P. (Univ., Paris). Delft Progr. Rep., Ser. B; 278: No. 22, 969-972(27 May 1974). (In French).

Wave mechanics for non-zero mass photons makes possible the introduction of an interaction between scalar photons and bosons (photons) which explains the anomalies recently observed in the properties of light in the vicinity of the Sun. (FR)

18055 LARGE–SCALE INHOMOGENEITY OF THE UNIVERSE: IMPLICATIONS FOR THE DECELERATION PARAMETER. Silk, J. (Department of Astronomy, University of California, Berkeley). Astrophys. J. 193: No. 3, 525-527 (1 Nov 1974).

The relationship is evaluated between relative density fluctuation and the associated deviation from the Hubble expansion for large–scale spherical inhomogeneities in Friedmann universes of arbitray q_0. Even if the most stringent limits hitherto suggested on local shearing motions over the Virgo supercluster region are adopted, q_0 need be no smaller than 0.1. However, the presently available data appear to be compatible with $q_0=0.5$. (auth)

18056 SOLAR GRAVITATIONAL DEFLECTION OF RADIO WAVES MEASURED BY VERY–LONG–BASELINE INTERFEROMETRY. Counselman, C.C. III; Kent, S.M.; Knight, C.A.; Shapiro, I.I. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Clark, T.A.; Hinteregger, H.F.; Rogers, A.E.E.; Whitney, A.R. Phys. Rev. Lett. 33: No. 27, 1621-1623 (30 Dec 1974).

Utilizing a four–antenna technique, we observed simultaneously, at each end of an 845–km baseline, the radio sources 3C279 and 3C273B, which are 10° apart in the sky. Differences in interferometric phases at 3.7–cm wavelength monitored near the time of the 1972 occultation of 3C279 by the sun, yielded a gravitational deflection of 0.99 ± 0.03 times the value predicted by general relativity, corresponding to $\gamma=0.98\pm0.06$ (standard error). (auth)

18057 GALAXY FORMATION FROM PRIMORDIAL TURBULENCE. Stein, R. (Brandeis Univ., Waltham, MA). Astron. Astrophys.; 35: No. 1, 17-29(Sep 1974).

The presence of large chaotic velocities in the early Universe would generate turbulence, which would in turn produce density and pressure fluctuations. Density fluctuations on the scale of clusters of galaxies (10^{13} to 10^{15} $M_\odot$) could be gravitationally bound, but galactic mass fluctuations would always be unbound. Galaxies would form when unbound galactic mass eddies, expanding faster than their bound cluster background, collided with each other as the cluster started to recollapse. These collisions would produce shocks and thus high density protogalaxies at the eddy interfaces. The galaxies would form rapidly. As the cluster recollapses, the system of galaxies would undergo a violent collective relaxation. (auth)

Planetary Phenomena

Refer also to abstracts 17958 and 17960.

18058 (AD-783538) MAGNETOSPHERE OF JUPITER AS OBSERVED WITH PIONEER 10. Parts I, II, and III. Progress Report. Van Allen, J. A.; Baker, D. N.; Randall, B. A.; Goertz, C. K.; Northrop, T. G. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy; National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). May 1974. Contract N00014-68-A-0196-0009. 127p. NTIS $9.50.

Results of an exploratory survey of the absolute intensities, energy spectra, and angular distributions of energetic electrons and protons as a function of position along the trajectory of the Pioneer 10 spacecraft through the magnetosphere of Jupiter are given. Also discussed are the nonrigid rotation of the magnetodisc and Jovian synchrotron radiation at 10.4 cm as deduced from observed electron fluxes. (GRA)

18059 (AD-783679) PIONEER X: OBSERVATIONS OF ENERGETIC ELECTRONS IN THE JOVIAN MAGNETOSPHERE. Randall, B. A. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy; National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). Jun 1974. Contract N00014-68-A-0196-0009. 43p. NTIS $5.25.

Results are given of a study of the intensities, energy spectra, and angular distribution of energetic particles in the magnetosphere of Jupiter; the heliocentric radial gradient of the intensity of galactic cosmic rays; and the occurrence, intensity, and angular distribution of solar-flare particles and their propagation through the interplanetary medium at large heliocentric distances. (GRA)

18060 PHOTOEMISSION AND SECONDARY ELECTRON EMISSION FROM LUNAR SURFACE MATERIAL. Willis, R. F.; Anderegg, M.; Feuerbacher, B.; Fitton, B. (European Scientific Research Organization, Noordwijk, Netherlands). pp 389-400 of Photon and Particle Interactions with Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

The photoelectric yield, secondary electron yield, and energy distribution of low energy electron emission from Apollo 14 and 15 dust samples are reported for photon energies, 4 to 21 eV, and incident electron energies, 50 to 2500 eV. The differential photoelectron flux and energy distribution spectrum due to solar irradiation are derived, and the results are used to estimate the electrical characteristics of the lunar photoelectron sheath. Auger electron spectroscopic analysis of the elemental composition of the lunar dust samples is described, and a comparison is made with the results obtained by the S-161 x-ray fluorescence experiment on-board the Apollo 15 Command Service Module, while in lunar orbit. The results are consistent with those expected for a finegrain, predominantly insulating, powder. (auth)

18061 MAGNETIC MEASUREMENTS OF THE SOLAR WIND INTERACTION WITH THE MOON. Lichtenstein, B. R.; Coleman, P. J. Jr.; Russell, C. T. (Univ. of California, Los Angeles). pp 471-480 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

The magnetic signature of the interaction between the Moon and the solar wind (as observed by the Apollo 15 subsatellite) is an enhanced field directly behind the Moon, bounded on either side by two dips in the field strength. On occasion, compressions of the field strength are observed external to either one or sometimes both of these dips. Theories of the interaction postulate either that these compressions are a general feature of the solar wind—Moon interaction modulated by changes in the solar-wind parameters or that they are associated with the appearance of specific lunar regions at the limbs. The measurements of the lunar magnetic field with the Apollo 15 and 16 subsatellites, the mapping of projected source positions of limb compressions onto the lunar surface, and the study of the persistence of limb compressions supports the hypothesis that limb compressions are formed when regions of high magnetization are at the lunar limbs. (IAA)

18062 ELECTRIC POTENTIAL OF THE MOON IN THE SOLAR WIND. Freeman, J. W. Jr.; Fenner, M. A.; Hills, H. K. (Rice Univ., Houston, TX). pp 363-368 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

Acceleration and detection of the lunar thermal ionosphere in the presence of the lunar electric field yields a value of approximately +10 V for the lunar electric potential for solar zenith angles between 20 and 45° and in the magnetosheath or solar wind. The ion number density of the thermal ionosphere observed is compatible with a surface neutral number density of about 100,000 atoms/cu cm. (auth)

18063 PLASMA AND POTENTIAL AT THE LUNAR SURFACE. Manka, R. H. (Rice Univ., Houston, TX). pp 347-361 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

The various plasma environments of the Moon are described for the lunar orbit through the solar wind and geomagnetic tail. The sources of lunar surface charge, including plasma, photo, and secondary currents, are compared for their expected range of values. The electric potential is calculated from probe theory as a function of local position on the lunar surface; the theory includes plasma environments which are both stationary and flowing. In agreement with several other calculations, the potential at the subsolar point is likely to be a few volts positive. (IAA)

18064 MEASUREMENT OF THE LUNAR PHOTOELECTRON LAYER IN THE GEOMAGNETIC TAIL. Reasoner, D. L.; Burke, W. J. (Rice Univ., Houston, TX). pp 369-386 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

Stable photoelectron fluxes (with energies between 40 and 200 eV) were observed by the Apollo 15 Charged Particle Lunar Environment Experiment (CPLEE). These observations, made in the magnetotail under near vacuum conditions, are compared with numerically calculated photoemission spectra to determine the approximate potential difference between ground and CPLEE'S apertures (a distance of 26 cm). Numerically calculated density and potential distributions are compared with the measured values to provide an estimate of the photoelectron yield function of the dust layer covering the Moon. (IAA)

18065 LUNAR ION FLUX AND ENERGY. Manka, R. H.; Michel, F. C. (Rice Univ., Houston, TX). pp 429-441 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

The dynamics of the lunar ionosphere and resulting flux of lunar ions to the lunar surface are reviewed. In the lunar rest frame, ions formed from the neutral lunar atmosphere are accelerated by the interplanetary electric and magnetic fields. The trajectories of heavier ions are primarily along the electric field; the ion flux is in a direction perpendicular to the solar-wind flow, correlated to the orientation of the interplanetary magnetic field, and impacts the surface with energies of tens of electron volts to a few keV. Thus a relatively energetic (compared to thermal energies), highly directional, lunar ion flux is predicted but with the possibility that light ions such as hydrogen can execute orbits that return them to portions of the lunar surface not directly exposed to the solar wind. The effects of surface electric and magnetic fields are discussed, as is the ion energy spectrum. The trapping of atmospheric ions which impact the surface is calculated and from this the density of neutral ^{40}Ar in the lunar atmosphere. It is shown that using the acceleration model, the lunar atmosphere total neutral number density can be calculated from ion detector data. (auth)

18066 LUNAR ELECTRONOSPHERE AND IMPLICATIONS FOR EROSION ON THE MOON. Walker, E. H. (Ballistics Research Labs., Aberdeen Proving Ground, MD). pp 521-544 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

Bodies in space that are subject to the solar ultraviolet emit photoelectrons. A portion of these escape, forming a current from the body balanced at equilibrium potential by accretion from the surrounding plasma. For a positively charged body, a much larger flux of less energetic photoelectrons will be released from the surface, but these will fail to escape from the body. Their effect is to produce an inner screening of the body's electric charge. The characteristics of this photoelectron sheath and the equilibrium surface potential are treated for spherical and flat bodies subject to the solar-wind electron and ion flux. The enhanced electric field resulting from the electronosphere gives rise on the Moon to electrostatic dust transport on the Moon. Evidence is found for the presence of electrostatic erosion as a contributory process in shaping lunar features on the 1- to 10-m scale. (IAA)

18067 SPUTTERING AND DARKENING OF THE GRAINS ON THE LUNAR SURFACE. Gold, T. (Cornell Univ., Ithaca, NY). pp 517-519 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB Conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

18068 LUNAR COMPOSITION FROM APOLLO ORBITAL MEASUREMENTS. Alder, I.; Trombka, J. I.; Yin, L. I. (Goddard Space Flight Center, Greenbelt, MD). pp 501-513 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

An x-ray spectrometer carried in the Service Module of the Apollo 15 and 16 spacecraft was employed for compositional mapping of the lunar surface. The surface measurements involved observations of the intensity and characteristic energy distribution of the fluorescent x rays produced by the interaction of the solar x rays with the lunar surface as well as naturally occurring gamma rays and cosmic-ray produced gamma rays. A large scale compositional map of approximately twenty percent of the lunar surface was obtained for the first time. It was possible to demonstrate differences between the highlands and the mare and to learn something about the composition of the Moon's hidden side. Results obtained from the x-ray experiment and the gamma-ray experiment are consistent with those obtained from lunar sample analysis. (auth)

18069 EVIDENCE FOR AN INTERNAL HEAT SOURCE IN NEPTUNE. Murphy, R.E. (Institute for Astronomy, University of Hawaii); Trafton, L.M. Astrophys. J. 193: No. 1, 253-255 (1 Oct 1974).

We show that Morrison and Cruikshank's 24—μ brightness temperatures of Uranus and Neptune are more properly interpreted as 30— to 40—μ brightness temperatures. Uranus is in equilibrium with the incident sunlight while Neptune appears to radiate 2.4 (+1.3, −0.9) times as much power as it absorbs. (auth)

18070 INTERPRETATION OF SATURN'S DECIMETRIC RADIO EMISSION. Condon, J.J. (National Radio Astronomy Observatory, Charlottesville, Virginia); Yerbury, M.J.; Jauncey, D.L. Astrophys. J. 193: No. 1, 257-261 (1 Oct 1974).

New pencil—beam observations of Saturn using the confusion—subtraction tracking technique yield equivalent disk brightness temperatures of 385°±49°K at 69.7—cm and 214°±15°K at 21.4—cm wavelength. Both the longer—wavelength results and comparison of the 21—cm pencil—beam and interferometric temperatures set strict upper limits to synchrotron emission from Saturn at shorter wavelengths. Nevertheless, existing data are not adequate for quantitative estimates of the relative contributions of the thermal and synchrotron mechanisms at wavelengths longer than 50 cm, and they can only set lower limits on the ammonia mixing ratio. (auth)

18071 DEKAMETRIC AND HECTOMETRIC OBSERVATIONS OF JUPITER FROM THE RAE—1 SATELLITE. Desch, M.D.; Carr, T.D. (Department of Physics and Astronomy, University of Florida, Gainesville). Astrophys. J. Lett. 194: No. 1, L57-L59 (15 Nov 1974).

Analysis of Rae—1 satellite data has revealed the presence of radio bursts from Jupiter in the frequency range from 4700 kHz to 450 kHz. Variations in the activity with respect to the planet's system III longitude are presented at seven frequencies. A merge of ground—based and satellite—acquired data indicates that the long—sought—for peak in Jupiter's low—frequency flux spectrum occurs at about 8 MHz. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 16301, 17787, 17964–17979, 17981–17986, 17988, and 17991.

18072 (AD-783512) INVESTIGATION OF PHENOMENA AFFECTING AURORAL IONOSPHERE. Final Report, 1 March 1973–30 April 1974. Cladis, J. B.; Davidson, G. T.; Francis, W. E.; Newkirk, L. L.; Walt, M. (Lockheed Missiles and Space Co., Palo Alto, Calif. (USA). Lockheed Palo Alto Research Lab.). 9 Jul 1974. Contract DNA001-73-C-0141. 70p. (LMSC-D-358493). NTIS $3.75.

Rocket data obtained during a magnetic substorm on 16 August 1970 indicates the auroral ionosphere was unstable to the high-frequency, Hall current, two-stream instability. This mechanism has been proposed to explain field-aligned ionospheric irregularities. Such irregularities were present during the rocket experiment. According to the theory, certain critical values of electron number density, current density, and relative electron–ion drift velocity must be exceeded for the instability to occur. An analysis is described in which calculated values of these quantities are derived from the rocket measurements of the dc electric field and the precipitating electrons. The results are found to exceed the respective critical values and enforce the conclusion that the field-aligned irregularities were produced by this instability. (GRA)

18073 (RSD-77) POSSIBILITY OF DEVELOPING THEORETICAL MODELS OF THE DISTURBED F-REGION. Somayajulu, Y. V. (National Physical Lab., New Delhi (India)). 1972. 11p.

The observed features of the disturbed F region, obtained from ground based and space borne experiments are briefly summarized. An attempt is then made to examine the possibility of developing theoretical models of the disturbed F region. (Indian Sci. Abstr.)

18074 CHARGED PARTICLE DISTRIBUTION IN THE NEAREST VICINITY OF IONOSPHERIC SATELLITES: COMPARISON OF THE MAIN RESULTS FROM THE ARIEL 1, EXPLORER 31, AND GEMINI-AGENA 10 SPACECRAFT. Samir, U. (Univ. of Michigan, Ann Arbor). pp 193-219 of Photon and Particle Interactions With Surfaces in Space. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From 6th ESLAB conference on photon and particle interactions with surfaces in space; Noordwijk, Netherlands (26 Sep 1972).

18075 CHANGES OF h′F-2 DURING MAGNETIC SUBSTORMS. Czechowski, L. (Univ., Warsaw). Acta Geophys. Pol.; 22: No. 2, 163-173(1974). (In Polish).

The present state of investigation about the influence of the thermospheric winds on the ionosphere during bay disturbances of the magnetic field is described. This paper presents the results of investigations concerning the changes of h′F-2 during 101 magnetic bays in 1970. The enhancement of h′F-2 for positive (in H) and for negative bays is found. At night the effect occurs between first and second hours after beginning of magnetic disturbance. The disturbance of h′F-2 attains its maximum between second and fourth hour. Decrease of h′F-2 follows after fourth hour. For positive bays in the day time or for negative bays, the change of h′F-2 is less significant but begins earlier. The simple model which explains these changes of h′F-2 is presented. Numerical results computed on the base of this model roughly agree with the observed changes of h′F-2 for positive magnetic bays in the night time. (auth)

18076 STUDY OF THE VARIATIONS OF ^{7}Be, ^{32}P, ^{90}Sr, ^{210}Pe, AND ^{210}Po IN THE TROPOSPHERE. Marenco, A.; Fontan, J. (Univ., Toulouse). Tellus; 26: No. 3, 386-400(1974). (In French).

Radioactive elements of various origins (^{7}Be, ^{32}P, ^{90}Sr, ^{210}Pb, ^{210}Po) have been measured at Toulouse in Southwestern France, for several years (1965 to 1969) in ground-level air with samplings of short duration (1 to 4 days), as well as in precipitations and air in altitude. The study of results shows the very important influence of precipitation scavenging processes upon the variations of activity. As concerns ^{90}Sr, the periodical variation connected with the exchanges between the stratosphere and the troposphere is confirmed, but it is shown that the increase recorded for ^{7}Be and ^{32}P in spring and summer, in ground-level air, is due to the variation in the precipitation scavenging processes and not to contributions from the stratosphere. In the case of ^{210}Pb, moreover, the origin of the air mass must be taken into account. The ^{90}Sr/^{7}Be ratio, allowing to eliminate the influence of scavenging, is quite suitable to characterize the air coming from the stratosphere, but no evidence is found, in ground-level air, of any relation with the possibilities of downward influx from the stratosphere. As concerns the ^{7}Be/^{32}P ratio, the results show the existence of a seasonal variation (maximum in winter) likely due to vertical exchange processes. An important discrepancy is noticed between the theoretical and experimental values of this ratio. The results obtained at Toulouse are in good accordance with those found at the same latitude, but a comparison between the measurements obtained in various stations tends to prove that the vertical exchanges are decreasing in summer above the oceans. The vertical distribution of the ^{210}Po/^{210}Pb ratio, deduced from the measurements in precipitations, leads, for the vertical exchange coefficient Kz, to values of about 3 to 6 m^2/s, and for the scavenging coefficient Λ_1, (air-layer between 2 and 6 km), to values of about 1/30 to 1/40 d^{-1}. Lastly, studies by simulation on models confirm the influence of the processes of precipitation scavenging and vertical exchanges. (auth)

18077 OBLIQUE RESONANCES IN THE IONOSPHERE. Gonfalone, A. (European Space Research and Tech. Centre, Noordwijk aan Zee, Netherlands). Radio Sci.; 9: No. 12, 1159-1163(Dec 1974).

A new diagnostic tool for space plasmas is presented. The oblique resonance excited by an antenna in a magnetoplasma has been detected in the ionosphere with a rocket experiment. The instrument is simple and consists of a fixed frequency transmitter and a receiver. The resonance cone and its fine structure are used to deduce the plasma density and the electron temperature. The possibility of measuring field-aligned currents is briefly discussed. (auth)

18078 EVALUATION OF NIGHTTIME EXPONENTIAL IONOSPHERIC MODELS USING VLF ATMOSPHERICS. Hughes, H. G.; Gallenberger, R. J.; Pappert, R. A. (Naval Electronics Lab. Center, San Diego, CA). Radio Sci.; 9: No. 12, 1109-1116 (Dec 1974).

Measurements of very low frequency atmospherics were made simultaneously at a station close to the lightning sources (Norman, Oklahoma) and at stations 1787 km (La Posta, California) and 5912 km (Kamuela, Hawaii) from Norman. Timing synchronization was maintained between stations to better than 10 μsec which, coupled with the source bearing from Norman, allowed accurate fixing of source locations. Using the numerical techniques of Pappert et al. for propagation parameter calculations, an appropriate exponential ionospheric conductivity model was chosen which best fit the modal interference structure near 10 kHz as a function of source distance as measured at La Posta. From source current moment spectra measured at Norman, the electric field strengths at La Posta and Kamuela were predicted for a wide frequency band (2 to 30 kHz) using the selected conductivity profile. For $\beta = 0.6$ km^{-1} and $h' = 84$ km (in the notation of Wait and Spies) good agreement between the numerical calculations and the average measured field strengths was obtained. (auth)

18079 SATELLITE MEASUREMENTS OF PHOTOELECTRON FLUXES. Wrenn, G. L. (University Coll., London). Ann. Geophys.; 30: No. 1, 49-57(Jan 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The importance of photoelectrons produced in the ionosphere has been appreciated for over a decade and there is now a good theoretical understanding of the physical processes involved. Unfortunately model calculations are hindered by a lack of suitable input data; this would not matter if reliable direct measurements of photoelectron fluxes were available. In fact very few experiments have been flown on satellites or rockets with such an objective and these have suffered from instrumental limitations. A brief discussion of the techniques, retarding potential analyzers and electrostatic analyzers, is given in order to establish confidence levels in the reported measurements. The photoelectron measurements are then presented in terms of energy spectra, pitch angle distributions and total flux intensities in an attempt to compile a picture of the photoelectrons which escape from the production regions. The production and escape processes clearly depend upon local time, latitude solar activity, etc. but the fact that the photoelectrons become pseudo-trapped is shown to strongly influence the fluxes and lead to significant implications for the heating of the protonosphere and the conjugate atmosphere. (auth)

18080 THEORY OF PHOTOELECTRON PRODUCTION, TRANSPORT, AND ENERGY LOSS. Nagy, A. F. (Univ. of Michigan, Ann Arbor). Ann. Geophys.; 30: No. 1, 43-48(Jan 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

Current understanding of the theory of ionospheric photoelectron production, transport and energy loss is summarized. The various approaches used in the theoretical calculations of photoelectron fluxes appear to be self-consistent and sound: improved values for a number of input parameters are needed now in order to achieve significant improvements and more confidence in the results. The major remaining problem in the present day theory of photoelectron transport and energy loss is centered around the calculations of photoelectron transit through the protonosphere. (auth)

18081 SURVEY OF THE ULTRAVIOLET AIRGLOW FROM 1216 A TO 304 A. Meier, R. R. (Naval Research Lab., Washington, DC). Ann. Geophys.; 30: No. 1, 91-104(Jan 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The airglow and celestial background in this region of the spectrum were observed from some eight rocket flights, from the Space Test Program STP 72-1 satellite, and from the lunar surface during the Apollo-16 mission. The interval from 800 to 1216 A is rich in spectral population, containing emissions from N, N_2, O, H, and several ionized species. Probable excitation mechanisms for these emissions include resonance scattering, photoelectron impact and dissociative excitation, and radiative recombination. Below 800 A He I 584 A and He II 304 A, both produced by resonance scattering of sunlight, appear to be the principal spectral features. The 584 A emission is found to be a sensitive measure of the latitudinal-seasonal variation of neutral helium (the winter bulge). Analysis of the 304 A observations shows that it is possible to determine optically the plasma-sphere morphology and its dynamic behavior. (auth)

18082 OXYGEN AIRGLOW EMISSIONS AND THE DYNAMICS OF THE UPPER ATMOSPHERE. Dachs, J. (Ruhr-Univ., Bouchum, Ger.). Ann. Geophys.; 30: No. 1, 85-90(Jan 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The knowledge of airglow emitting reactions and atmospheric composition may be used to interpret the observed temporal and geographic intensity variations of oxygen airglow emissions in terms of circulation systems and dynamical processes in the upper atmosphere changing the local densities of excited oxygen atoms and molecules. The correlations which were found between ionospheric parameters and oxygen nightglow intensity measurements are reviewed in order to show that horizontal and vertical plasma drifts and neutral winds in the F2 and E regions of the ionosphere can be studied by recording the daily variations of visible and ultraviolet oxygen airglow line emissions. Evidence is presented that the seasonal intensity variations of the [OI]λ 5577 A nightglow emission found at many ground-based observatories are related to seasonal variations of the local atomic oxygen densities at the 100 km height level of the atmosphere. (auth)

18083 INVESTIGATION OF THE INTEGRAL CHARACTERISTIC OF THE EARTH'S IONOSPHERE BY MEANS OF A DISPERSION INTERFEROMETER DURING THE FLIGHT OF THE LUNA-19 SPACE STATION. Vasil'ev, M. B.; Vyshlov, A. S.; Kolosov, M. A.; Mesterton, A. P.; Savich, N. A.; Samovol, V. A.; Samoznaev, L. N.; Sidorenko, A. I.; Shtern, D. Ya. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 78-81(1974).

Translated from Kosm. Issled.; 12: No. 1, 87-91(1974).

The integral electron density of the ionosphere and its variation in time were measured by means of a multifrequency dispersion interferometer whose transmitter was mounted on the Luna 19 space station. The smoothed-out experimental integral electron density in a vertical column N_{io} is given as a function of the time of the day. The rate of time variation of N_{io}, which depends on the daily variation of the ionosphere and its structural nonuniformity, is determined. (auth)

18084 TRANSFER OF ENERGY TO THE UPPER ATMOSPHERE BY AN IMPULSE X-RAY SOURCE. Kudryavtsev, V. P.; Pronina, L. I.; Strelkov, A. S. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 82-88(1974).

Translated from Kosm. Issled.; 12: No. 1, 92-99(1974).

An approach to analysis of ionization of the surrounding medium under the influence of x radiation, as well as the phenomena occurring with motion of photoelectrons in the upper atmosphere, is proposed. In determining ionization of the medium by x radiation, consideration is taken of the absence of localization in the absorption of radiation, as a result of which there develop uncompensated fluxes of photoelectrons and electromagnetic fields. For numerical calculations the source characteristics are taken as corresponding to those of the American nuclear explosion Starfish. The value of energy liberation obtained agrees well with experimental data. The calculated value of electric field intensity was E = 2 mV/m. A calculation of the electron gas temperature was conducted. (auth)

18085 PHENOMENOLOGICAL REPRESENTATION OF PROPAGATION PATH OF ELECTROMAGNETIC PULSES THROUGH THE IONOSPHERE AND SOLAR CORONA. Ivanov, V. V.; Chudnovskii, L. S. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 97-107(1974).

Translated from Kosm. Issled.; 12: No. 1, 109-114(1974).

A phenomenological representation of the path by which electromagnetic pulses propagate through a quasihomogeneous plasma with random inhomogeneities is discussed for the case of high frequencies. Since the path is of a random nature in this instance, estimates of the statistical characteristics of the Sommerfold attenuation factor were in order. Since the authors were interested only in the frequency dependence of the statistical characteristics, the remaining parameters were treated as phenomenological constants. (auth)

18086 INTERACTION OF PHOTOELECTRONS WITH PLASMA OSCILLATIONS. Kolokolov, L. E. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 123-125(1974).

Translated from Kosm. Issled.; 12: No. 1, 138-140(1974).

The theoretical investigation of the energy contribution of photoelectrons to both the local and the conjugate ionosphere is based on a consideration of their elastic and inelastic interactions with the neutral atmospheric constituents. The influence of plasma oscillations induced by a beam of photoelectrons on the energy relaxation of those photoelectrons is assessed. The analysis was carried out in the one-dimensional approximation, assuming that the photoelectrons move predominantly along a magnetic field strong enough to suppress oscillations propagating obliquely with respect to the direction of motion of the photoelectrons. (WDM)

Magnetospheric Phenomena

Refer also to abstracts 17957, 17980, and 18269.

18087 PROPAGATION OF PERTURBATIONS OF THERMODYNAMIC PARAMETERS FROM THE UPPER ATMOSPHERE DOWNWARDS DURING PERIODS OF GEOMAGNETIC DISTURBANCES. Bekoryukov, V. I.; Purganskii, V. S. pp 186-197 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

18088 INFLUENCE OF PHOTOELECTRON AND SECONDARY ELECTRON EMISSION ON ELECTRIC FIELD MEASUREMENTS IN THE MAGNETOSPHERE AND SOLAR WIND. Grard, R. J. L.; Knott, K.; Pedersen, A. (European Scientific Research Organization, Noordwijk, Netherlands). pp 163-189 of Photon and Particle Interactions With Surfaces in Space; Noordwijk, Netherlands (26 Sep 1972).

The feasibility of electric field measurements by the double sphere technique both inside and outside the magnetosphere is critically reviewed. In particular, influences resulting from photoemission, secondary electron emission, and the plasma environment are analyzed. It is concluded that a double sphere aerial, 50 to 100 m long, can measure dc electric fields as low as 0.1 mV/m in the solar wind and during conditions with ambient electron current density below 0.000001 A/sq m in the magnetosphere, provided certain precautions are taken regarding probe symmetry. In the magnetosphere, for current densities larger than 0.000001 A/sq m, the space charge of photoelectrons escaping from the satellite will give rise to potential asymmetries near the probes, and an electron gun is required for control of the satellite potential and reduction of space charge asymmetries. (auth)

18089 STUDY OF HIGH-ENERGY ELECTRONS IN THE STRATOSPHERE. Bezus, V. A.; Gal'per, A. M.; Grigorov, N. L.; Dmitrenko, V. V.; Kalinkin, L. F.; Kirillov-Ugriumov, V. G.; Luchkov, B. I.; Melioranskii, A. S.; Savenko, I. A.; Shermanzon, E. M. pp 112-125 of Izuchenie Kosmicheskikh Luchei na Iskusstvennykh Sputnikakh Zemli. Shtern, M. I. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

A balloon-borne instrument using a multilayer spark chamber to measure incoming and outgoing electron fluxes with energies above 100 MeV in the upper atmosphere is described. Large variations of the incoming flux and a correlation between these variations and the state of the magnetosphere were observed in experiments carried out during 1967 to 1968. The effect is attributed to the capture by the earth's magnetosphere of electrons with energies above 100 MeV precipitating during magnetic field disturbances. (IAA)

18090 NORTH–SOUTH ASYMMETRY OF GEOMAGNETIC AND TROPOSPHERIC PHENOMENA. Mansurov, S. M.; Mansurov, G. S.; Mansurova, L. G. pp 271-280 of Sun–Atmosphere Relations in Climate Theory and Weather Forecasts. Leningrad; Gidrometeoizdat (1974). (In Russian).

From conference on sun–atmosphere relations in climate theory and weather forecasts; Moscow, USSR (30 Oct 1972).

Evidence for the existence of a north–south asymmetry in variations of the geopotential in both hemispheres is obtained by a study of radio sounding data at two magnetically conjugated stations. Published studies dealing with the sector structure of the interplanetary magnetic field are reviewed in the context of the north–south geopotential asymmetry. (IAA)

18091 NORTH–SOUTH ASYMMETRY OF RADIATION RECORDED BY GAS-DISCHARGE DETECTOR ON CLOSED DRIFT ENVELOPES. Tsaplin, V. S.; Shavrin, P. I. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 126-127(1974).

Translated from Kosm. Issled.; 12: No. 1, 141-142(1974).

Individual STS-5 gas-discharge counters were installed on board the satellites Kosmos 134 (December 3, 1966) and Kosmos 136 (December 19, 1966) launched into orbit with the parameters: apogee ~350 km, perigee ~200 km, angle of inclination of plane of equator 65°. The counters differed by not more than 10% in the efficiency with which they recorded the charged component and were capable of recording protons of energy $E_p > 60$ MeV and electrons of energy $E_e > 8$ MeV in a direct pass. The virtual simultaneity of the satellite flights and the absence during the period in question of any significant variants in cosmic radiation or geomagnetic disturbances made it possible to treat the entire mass of data together, thereby enhancing the statistical accuracy. (WDM)

18092 POSSIBLE EFFECTS OF PLASMA TURBULENCE IN THE VICINITY OF DIURNAL POLAR CUSPS. Gudkova, V. A.; Liperovskii, V. A.; Shalimov, V. P. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 54-58(1974).

Translated from Kosm. Issled.; 12: No. 1, 62-66(1974).

Existing theoretical evaluations of the energy fluxes within the magnetosphere through the diurnal polar cusp region do not correspond with available experimental data. This study will evaluate the possible effect of development of energy and particle fluxes corresponding to experiment within the magnetosphere due to ion sound turbulence at the cusp boundary. (auth)

18093 BOW SHOCK AND α COMPONENT IN THE TRANSITION REGION. From Measurements on the High-Latitude Satellite Prognoz. Vaisberg, O. L.; Zertsalov, A. A.; Temnyi, V. V.; Berezin, Yu. E. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 1, 72-77(1974).

Translated from Kosm. Issled.; 12: No. 1, 80-86(1974).

The times of intersection of the magnetospheric bow shock by the Prognoz satellite were determined from measurements of the ion component of the plasma. The mean position of the shock was determined for the period 4-15- to 9-17-1972, in the conic section approximation, and without allowing for the aberration angle. The distance of the shock at its flank was ~28.6 R_E radii, which is much larger than values from other experiments. A possible reason is that Prognoz intersected the shock at higher latitudes. From measurements of the energy spectrum of α particles of the solar wind and in the transition region the temperature jump and the velocity of the α component of the plasma were determined. The values obtained differ a great deal from values calculated from the gas dynamic flow model and from results of measurement of the proton component of the solar wind. At small angles (~30°) and at large angles (~70°) from the forward stagnation point the jump in the transition velocity of α particles is ~0.85 and the temperature jump is ~7, i.e., considerably less than for protons. Evidently, the α particle and proton transition velocities are not equal in the transition region. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstract 17101.

18094 (AD-784187) POSSIBILITY OF MEASURING DIFFERENTIAL FUNCTIONS OF EXCITATION AND IONIZATION BY DOUBLE MODULATION OF AN ELECTRON BEAM. Zaslavskii, V. Ya. Translated by M. Olaechea from Vysokomol. Soedin., Ser. B; No. 12, 49-55(1971). 12p. (FTD-HT-23-2723-74). NTIS $3.00.

The discussion covers electron beams and ionization potentials. (JFP)

18095 (EUR-CEA-FC-737) CHARGE EXCHANGE BY ION INTERACTION WITH SOLID MICROPARTICLES. Fiat, G.; Geller, R.; Juillet, F.; Ludwig, P.; Mereaudeau, P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service d'Ionique Generale). Apr 1974. 28p. (In French). Dep. NTIS (US Sales Only) $4.50.

A rudimentary device that furnishes a beam of solid particles of TiO_2 ($\geq$100 Å) is proposed in order to avoid the usage of solid foils. These particles are capable of crossing and interacting with an ion beam of 20 to 150 keV. (auth)

18096 (EUR-CEA-FC-741) FORMATION AND EXTRACTION OF POLARIZED PROTONS FROM A PLASMA AT THE ELECTRON GYROMAGNETIC RESONANCE. Geller, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). May 1974. 24p. (In French). Dep. NTIS (US Sales Only) $4.25.

A type of ion source designed for producing a beam as intense as possible from a jet of polarized hydrogen atoms is proposed (flux about 10^{16} at/cm^2/sec, directed velocity of the polarized atoms 3.10^5 cm/sec). Problems of optimum ionization of the polarized atoms and extraction of the polarized protons from the source are studied. The useful, unfavorable and dangerous collisions which the atomic jet is subjected to when encountering the ionization medium are considered. Two kinds of difficulties are considered in view of appreciating feasibility (difficulties in ionizing polarized ions). In both cases a hierarchy or the useful and unfavorable characteristic times is established. The proposed source is described. (EUR)

18097 (JINR–P11-8356) PROGRAM FOR CALCULATING THE PARAMETERS OF THE STATIONARY SELF-CONSISTENT BEAM OF RELATIVISTIC ELECTRONS. Zhidkov, E. P.; Semerdzhiev, Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Technqiues and Automation). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A brief description is given of a subprogram package intended for calculation of parameters of a stationary self-consistent beam of relativistic electrons. The block-diagram of the program is presented. (auth)

18098 SURFACE AND VACUUM PHYSICS INDEX. Volume 9, No. 9, 1974. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 50p.

18099 VARIABLE ENERGY NEUTRAL MOLECULAR BEAM SOURCE FOR LARGE MOLECULES. Greene, D.B.; Halprin, E.A.; Skofronick, J.G. (Florida State University, Tallahassee, Florida 32306). Rev. Sci. Instrum. 46: No. 2, 136-139 (Feb 1975).

A variable energy neutral beam source is presented which utilizes a class of large molecules having the property of forming long–lived temporary negative ions. Negative ions are produced, accelerated, and focused, after which autodetachment of the electrons occur, leaving a beam of neutral molecules. The source has been used in total cross section experiments, where SF_6 was the beam gas and various target gases were used in a scattering cell. Some results of the collision process $SF_6 + CO_2$ are presented. At 1200 eV lab energy (27 eV c.m. energy) the total collision cross section for CO_2 is 54.2 ± 15.9 Å^2. Advantages and disadvantages of this type of source are discussed, and extensions to other types of experiments are explored. (auth)

18100 RADIATIONLESS DEEXCITATION OF EXCITED HELIUM ATOMS AT SURFACES. Baird, W.E.; Zivitz, M.; Larsen, J.; Thomas, E.W. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). Phys. Rev. A 10: No. 6, 2063-2069 (Dec 1974).

Impact of 20–30–keV He^+ ions on polycrystalline niobium and copper surfaces causes some projectiles to be backscattered in a neutral excited state. These projectiles subsequently decay, radiatively emitting Doppler–broadened spectral lines; the broadening is characteristic of the distribution in speeds and direction of the scattered excited projectiles. Analysis of the line shape shows that slow reflected particles have a high probability of losing the excited electron by a radiationless transition while they are close to the surface. The spectral line shape has been predicted using the backscattering theory of McCracken and Freeman with the inclusion of a radiationless deexcitation term. By suitable choice of the radiationless deexcitation coefficients the theory and experiment may be brought into acceptable agreement. The coefficients so derived are in surprising agreement with calculated values of Cobas and Lamb for an Auger deexcitation mechanism. (auth)

18101 REDUCTION OF THE ANGULAR DIVERGENCE OF A MOLECULAR BEAM BY A COAXIAL BEAM OF ELECTRONS. Bobbio, S.M.; Chiou, C.T.; Greene, E.F.; Lambropoulos, H.D. (Metcalf Chemical Laboratories, Brown University, Providence, Rhode Island 02912). J. Chem. Phys. 62: No. 1, 190-196 (1 Jan 1975).

The angular divergences of molecular beams of several species are reduced substantially if they move coaxially with an electronic beam. The flux of molecules observed arriving at a detector set on the axis of the molecular beam is increased by factors up to 10^3 for a beam of KCl and 10^2 for a beam of K. The increases become smaller as the intensity of the beams is increased. A model proposed to account for the results attributes the collimating action of the electronic beam to the decreased energy of states of the molecules and atoms in the field produced by the electronic beam. (auth)

18102 PARTICLE EMISSION FROM METAL SURFACES IRRADIATED WITH MeV PROTONS. Robinson, J.E.; Thompson, D.A. (Department of Engineering Physics and Institute for Materials Research, McMaster University, Hamilton, Ontario, L8S 4M1, Canada). Phys. Rev. Lett. 33: No. 26, 1569-1572 (23 Dec 1974).

Particle emission yields from cold–rolled and annealed Fe, Nb, and Au surfaces under MeV proton bombardment are reported. 16–MeV protons are used to simulate the surface sputtering by 14–MeV neutrons which is of interest for nuclear fusion. Sputtering yields of less than 2×10^{-4} are reported. "Chunk emission" is not observed. (auth)

18103 FIELD–ION SPECTROSCOPY OF ELECTRONIC STATES AT CLEAN AND ADSORBATE–COVERED TUNGSTEN SURFACES. Utsumi, T.; Smith, N.V. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. Lett. 33: No. 21, 1294-1297 (18 Nov 1974).

Measurements are reported of the kinetic energy distributions of field–ionized noble gases on both clean and nitrogen–adsorbate–covered surfaces of tungsten. The structure observed is attributed to the energy distribution of unoccupied electronic states at the metal surface. Correspondences are found with recent calculations of one–dimensional densities of states. A nitrogen–adsorption peak is observed at 0.6 eV above the Fermi energy. (auth)

18104 HIGH-PRECISION SKIMMERS FOR SUPERSONIC MOLECULAR BEAMS. Gentry, W. R.; Giese, C. F. Rev. Sci. Instrum.; 46: No. 1, 104(Jan 1975).

High quality skimmers for supersonic molecular beams may be fabricated in a variety of shapes by a method which involves both electroforming and machining operations. (auth)

18105 FOCUSING OF POLAR MOLECULES IN AN ELECTROSTATIC QUADRUPOLE: THE USE OF A COLLIMATING ORIFICE TO REMOVE THE DIRECT BEAM. Bromberg, E. E. A. (Weizmann Inst. of Science, Rehovot, Israel). Rev. Sci. Instrum.; 46: No. 1, 24-29(Jan 1975).

In electrostatic quadrupoles, which are used to focus state-selected beams of polar molecules, it is customary to use a beam stop to prevent the direct nonfocused beam from striking the detector. An alternative method would be the use of a pair of electrostatic quadrupoles with a central collimating orifice, as described below, to separate the state-selected beam from the parent beam. It is shown that, in general, a double quadrupole system with a central orifice has a much lower background signal and can have a larger transmission than the quadrupole system using a beam stop. The arguments given are for a lens system containing no field-free regions; the extension to a system with field-free regions is straightforward. (auth)

18106 INTERNAL ENERGY EXCHANGE IN MOLECULAR COLLISIONS WITH A CRYSTAL. Rowe, R.G.; Ehrlich, G. (Coordinated Science Laboratory and Department of Metallurgy, University of Illinois at Urbana–Champaign, Urbana, Illinois 61801). J. Chem. Phys. 62: No. 2, 735-737 (15 Jan 1975).

The angular distribution of the scattered intensity has been measured for beams of molecular hydrogen and its isotopes colliding with a MgO surface. In the analysis of the spectra, it is not found necessary to invoke phonon excitation. The exchange of energy between internal degrees of freedom and translation gives a good account of the experiments. (AIP)

Atomic and Molecular Properties

Refer also to abstracts 16123, 17532, 18100, 18169, 18185, 18186, and 18188.

18107 POLARIZATION DEPENDENCE OF THE MULTI-PHOTON IONIZATION PROBABILITY. Bakos, J.; Kiss, A.; Szabo, L.; Tendler, M. (Central Research Inst. for Physics, Budapest). pp 18 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The Langmuir probe method was used to detect the helium ions produced by high intensity laser radiation. The Nd-glass laser was Q-switched by a rotating prism and frequency tuned by rotating the intercavity Fabray–Perot interferometer. The laser rod was cut at Brewster angle and additional glass plates were put into the laser resonator so as to increase the degree of polarization of the radiation. The effect of polarization on ionization of the triplet metastable helium atoms is discussed. (MOW)

18108 FREQUENCY DEPENDENCE OF THE MULTIPHOTON IONIZATION OF THE METASTABLE HELIUM ATOMS. Bakos, J.; Nagaeva, M. L.; Ovchinnikov, V. G.; Rubin, G. (Lebedev Inst. of Physics, Moscow). pp 19 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

The metastable He atoms were obtained in a dc gas discharge ($I \sim 5$ mA) in a long glass tube. The pressure of the helium gas was a few mm Hg. The discharge in the tube was switched off periodically and the afterglow plasma was irradiated by a Q-switched ruby laser. The density of the metastable atoms amounted to $\sim 10^{12}$ cm^{-3}. The ions produced were measured with a Langmuir probe. Some results are given. (MOW)

18109 ATOMIC MULTIPLET IN INTENSE VARIABLE FIELD. Katsnelson, B. G.; Zon, B. A. (Voronezh State Univ., USSR). pp 26 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Solutions are given for multiplet levels in the field of optic or infrared frequencies. The following assumptions were made: (1) the frequency of the external field $\omega \gg \Delta$, (2) multiplet is localized in the spectrum of the atom $\Delta \ll D$ (D is distance to nearest level, mixed with multiplet), and (3) if there is no resonance on frequencies ω and 2ω, the field doesn't mix multiplet with the nearest levels. (MOW)

18110 PHOTO-IONIZATION CROSS SECTION OF THE $1s^22p^2p^0$ STATE OF Li. Mikhalev, V. V.; Ogorodnikov, S. N.; Pankratov, V. G. Zh. Prikl. Spektrosk.; 20: No. 6, 1079-1081 (Jun 1974). (In Russian).

The photoionization cross section of the $2p^2P_{1/2, 1/2}$ state of Li was measured. Experimental data agreed with earlier published theoretical results. Attention is given to the peculiarities of the methods for determining electron temperatures in a lithium plasma. (tr-auth)

18111 RELATIVE INTENSITIES OF X-RAY K BANDS OF TRANSITION METALS. Nikiforov, I. Ya.; Geguzin, I. I.; Al'perovich, G. I. (Rostov State Univ., USSR). Bull. Acad. Sci. USSR, Phys. Ser. (Engl. Transl.); 38: No. 3, 147-150(1974).

From 10th all-union conference on x-ray spectroscopy; Alma-Ata, USSR (11 Sep 1973). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 3, 599-602(1974).

A consistent calculation of the relative integrated intensity of the x-ray K emission bands of metals from V to Cu was made on the basis of a single-electron calculation of the band structure by the Green's function method, with account taken of the dipole and quadrupole transitions (1s-p and 1s-d). Results agree well with experiment. The number of valence p electrons per atom inside the sphere inscribed in the atomic polyhedron does not exceed 0.7 e/atom. (DLC)

18112 X-RAY SPECTRA AND ELECTRONIC STRUCTURE OF INTERMETALLIC COMPOUNDS WITH LATTICE OF THE LAVES PHASE TYPE. Trofimova, V. A.; Nemnonov, S. A.; Kolobova, K. M. (Inst. of Metal Physics, Sverdlovsk, USSR). Bull. Acad. Sci. USSR, Phys. Ser. (Engl. Transl.); 38: No. 3, 190-192(1974).

From 10th all-union conference on x-ray spectroscopy; Alma-Ata, USSR (11 Sep 1973). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 3, 649-651(1974).

A study was made of the fluorescence K spectra of Ti and Fe in $TiCr_2$, $TiMn_2$, $TiFe_2$, $TiCo_2$, $ZrFe_2$, $HfFe_2$, and $MoFe_2$. It is shown that the use of the average electron density and interatomic distances alone cannot explain the spectra, but that the use of the concept of covalent-binding electrons with allowance for the crystal chemistry of this class of compounds explains the results. (DLC)

18113 MULTIPLET STRUCTURE OF X-RAY AND ELECTRONIC SPECTRA OF RARE-EARTH ELEMENTS. Demekhin, V. F.; Poltinnikova, T. M.; Bairachnyi, Yu. I.; Shelkovich, T. V.; Sukhorukov, V. L. (Rostov State Univ., USSR). Bull. Acad. Sci. USSR, Phys. Ser. (Engl. Transl.); 38: No. 3, 142-146(1974).

From 10th all-union conference on x-ray spectroscopy; Alma-Ata, USSR (11 Sep 1973). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 3, 593-598(1974).

The fine structure of x-ray emission and absorption spectra, and also of electronic spectra of rare-earth elements, is interpreted on the basis of a calculation of the multiplet structure of the x-ray levels. (26 references, 5 fig) (auth)

18114 THEORETICAL STUDY OF X-RAY EMISSION SPECTRA PRODUCED UPON IONIZATION OF THE 4d SHELL OF RARE EARTH METAL ATOMS. Karosene, A. V.; Karaziya, R. I.; Kiselev, A. A.; Shadzhyuvene, S. D.; Zimkina, T. M.; Fomichev, V. A. (Inst. of Physics and Mathematics, Vilnyes, USSR). Bull. Acad. Sci. USSR, Phys. Ser. (Engl. Transl.); 38: No. 3, 1-7(1974).

From 10th all-union conference on x-ray spectroscopy; Alma-Ata, USSR (11 Sep 1973). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 3, 426-433(1974).

The x-ray emission spectrum produced following ionization and excitation of rare-earth-atom 4d shells by fast electrons in a solid are studied theoretically. The probabilities of production of ionized and excited states and the probabilities of emission transitions with participation of 4f and 5p electrons are considered, and their dependence on the number of electrons in the $4f^N$ subshell are considered. The intensities of various lanthanum transitions are calculated in the first Born approximation with Hartree–Fock wave functions. The theoretical results help refine the interpretation of the complex structure of the spectra. (auth)

18115 EFFECT OF ENVIRONMENT ON RARE EARTH ION SPECTRA. Korol'kov, V. S.; Makhanek, A. G. Zh. Prikl. Spektrosk.; 20: No. 6, 1095-1098(Jun 1974). (In Russian).

Predictions based on crystal-field theory and a cluster model are compared with regard to the effect of the immediate environment of a rare earth ion on its spectrum. The dependence of the parameters of the phenomenological theory of a crystal field on the angular coordinates of the ligands is similar in the two models. Predictions from the models differed qualitatively relative to the effect on the spectrum of changes in distance to the ligands. Predictions based on the cluster model agreed with experimental data. (tr-auth)

18116 SHIFTS OF HARD X-RAY LINE DUE TO SEVERAL VACANCIES IN ELECTRONIC SHELLS. Karaziya, R. I.; Grabauskas, D. V.; Kiselev, A. A. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 2, 249-260(1974). (In Russian).

A general expression to calculate the shift of a hard x-ray line due to several vacancies in the same or different shells is obtained and the relations among the shifts due to the removal of electrons from different configurations of the atom are found. The calculations for elements of the fifth and the sixth period were made through the solution of Hartree-Fock equations. The terms nonadditive in respect of the number of the removed electrons are essential for the s- and p-type vacancies, however, their effect in the atomic set is, in part, compensated because of reduction of additive terms. (auth)

18117 X-RAY LUMINESCENCE OF LiD-MONO-CRYSTALS ACTIVATED BY Hg-LIKE IONS. Terent'ev, G. I.; Gavrilov, F. F.; Repin, G. V.; Slesarev, A. I.; Cholakh, S. O.; Shul'gin, B. V. Zh. Prikl. Spektrosk.; 20: No. 6, 1006-1009(Jun 1974). (In Russian).

The x-ray and thermally stimulated luminescence (XL, TSL) of LiD-Me^{n+} monocrystals were studied, where Me^{n+} is an ion similar to the mercury ion. The XL spectra at 78°K were broad bell-shaped bands with maxima at 600, 612, 520, and 486 nm for the activators Ge^{2+}, Sn^{2+}, Bi^{3+}, and Sb^{3+}, respectively. At 300°K, the XL spectra were shifted to the long-wave region. The luminescence is related to the $^3P_1-{}^1S_0$ transition in the Me^{n+}. The chief TSL peaks are related to the introduction of the Me^{n+} ions and are in the 245-275 and 310-330°K region. In the TSL spectra, upon recording of the total luminescence, there are additional peaks in the 90-220°K region. It is suggested that the plane of capture responsible for the additional peaks is due either to inherent defects in the lattice or to the presence of noncontrolled impurities the levels of capture for LiD–Me^{n+} are 0.24 to 0.83 eV. The possibility of using the TSL in LiD–Me^{n+} for x-ray dosimeters is suggested. (tr-auth)

18118 SURFACE STATES OF METASTABLE He_2 ON LIQUID HELIUM. Arrighini, G. P. (Univ., Pisa, Italy); Biondi, F.; Guidotti, C. Phys. Lett.; 48A: No. 5, 385-386(15 Jul 1974).

Excited He_2^* molecules created by radioactive sources in liquid helium can escape into the vacuum. Possible bound states outside the liquid surface are suggested to exist. (auth)

18119 THEORETICAL STUDY OF HELIUM RYDBERG STATES. Chang, T.N.; Poe, R.T. (Department of Physics, University of California, Riverside, California 92502). Phys. Rev. A 10: No. 6, 1981-1985 (Dec 1974).

A detailed theoretical investigation of the helium atomic Rydberg states is carried out. Results for level transition energies and doublet level splittings are found to agree extremely well with the recent high–precision microwave–optical experiments. The physical effects contributing to the electrostatic fine structures are systematically studied. (auth)

18120 CORRELATIONS OF EXCITED ELECTRONS. THE STUDY OF CHANNELS IN HYPERSPHERICAL COORDINATES. Lin, C.D. (Department of Physics, University of Chicago, Chicago, Illinois 60637). Phys. Rev. A 10: No. 6, 1986-2001 (Dec 1974).

According to early experiments and calculations, doubly excited states of helium are grouped into channels (Rydberg series and continua) with very different excitation and decay probability. Macek has identified channels by using hyperspherical coordinates $[R = (r_1^2 + r_2^2)^{1/2}, \tan\alpha = r_2/r_1, \Omega \equiv \{\alpha, \hat{r}_1, \hat{r}_2\}]$ and solving the Schrödinger equation initially at fixed R; each eigenvalue $U_\mu(R)$ and eigenfunction $\Phi_\mu(R;\Omega)$ characterizes one channel and the approximate solution of the whole equation has the form $F_\mu(R)\ \Phi_\mu(R;\Omega)$. We study the electron correlations in each channel by obtaining explicit expressions for $\Phi_\mu(R;\Omega)$, and extend the range of Macek's investigation to higher channels. Pairs of orbital quantum numbers (l_1,l_2) are found to be quasiconstants for each channel; channels with the same (l_1,l_2) and (L,S,π) differ mainly in the degree of excitation of the radial correlation. Channel functions $\Phi_\mu(R;\Omega)$ of ^1S, $^1P+$, and $^3P+$ channels have an antinode at or near $\alpha = 45°$, while those of ^3S, $^1P-$, and $^3P-$ channels have a node at or near $\alpha = 45°$. An antinode or a node appears to occur generally at or near $\alpha = 45°$. This location of nodes in the minus and ^3S channels is shown to be related to the weakness of coupling both among these channels and to plus channels with the same (L,S,π) symmetry. Examples for H^- are discussed. The interactions between channels with different (l_1,l_2) are important where their potential curves are nearly degenerate. Examples of the effect of this degeneracy in the spectra of alkaline–earth atoms are indicated. (auth)

18121 NUCLEAR HEXADECAPOLE SHIELDING FACTOR FOR THE HOLMIUM ATOM. Sternheimer, R.M. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. A 10: No. 6, 1964-1971 (Dec 1974).

The nuclear hexadecapole shielding factor R_H for the 4f electrons of the holmium atom $(Z = 67)$ has been obtained. This calculation was carried out in connection with a recent atomic–beam experiment of Dankwort, Ferch, and Penselin, which indicates the presence of a nuclear hexadecapole interaction with the 4f electron, leading to a value of the nuclear hexadecapole moment $H(Ho^{165}) = 0.8 \times 10^{-48}$ cm^4. This result has to be corrected for shielding or antishielding effects of the holmium atomic core electrons on the 4f electron, which experiences the interaction with the nucleus. The present paper gives the procedure and the results of the calculation of R_H, which was found to be $+ 0.24$ (shielding). Thus the value of the moment $H(Ho^{165})$ obtained by Dankwort et al. should be multiplied by the factor $1/(1-R_H) = 1/0.76$, giving a corrected value $H(Ho^{165})_{corr} = 1.06 \times 10^{-48}$ cm^4. (auth)

18122 DIPOLE PROPERTIES OF ATOMS AND MOLECULES IN THE RANDOM PHASE APPROXIMATION. Martin, P.H.S. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91109); Henneker, W.H.; McKoy, V. J. Chem. Phys. 62: No. 1, 69-79 (1 Jan 1975).

A random phase approximation (RPA) calculation and a direct sum over states is used to calculate second–order optical properties and van der Waals coefficients. A basis set expansion technique is used and no continuumlike functions are included in the basis. However, unlike other methods we do not force the basis functions to satisfy any sum–rule constraints, but rather the formalism (RPA) is such that the Thomas–Reiche–Kuhn sum rule is satisfied exactly. Central attention is paid to the dynamic polarizability from which most of the other properties are derived. Application is made to helium and molecular hydrogen. In addition to the polarizability and van der Waals coefficients, results are given for the molecular anisotropy of H_2, Rayleigh scattering cross sections, and Verdet constants as a function of frequency. Agreement with experiment and other theories is good. Other energy-weighted sum rules are calculated and compare very well with previous estimates. The practicality of our method suggests its applications to larger molecular systems and other properties. (auth)

18123 NATURAL ORBITALS OF SEVERAL EXCITED STATES OF THE He ATOM. Winkler, P. (Department of Chemistry and Department of Physics, State University of New York, Stony Brook, New York 11794); Porter, R.N. J. Chem. Phys. 62: No. 1, 257-271 (1 Jan 1975).

A method is devised by which natural orbitals of the excited states of atomic two–electron systems can be calculated from integral transform wavefunctions of the kind described previously [J. Chem. Phys. 61, 2038 (1974)]. Illustrative calculations are presented for several singlet and triplet states of He. It turns out that excited *S* states of the He atom can be analyzed with sufficient accuracy in terms of natural *s* orbitals alone. This is not true for the ground state, which is considered here mainly in order to compare some of the present results to values obtained previously by different methods. (auth)

18124 ON THE ISOTROPIC OSCILLATOR AND THE HYDROGENIC ATOM IN CLASSICAL AND QUANTUM MECHANICS. Rockmore, R. (Physics Department, Rutgers University, New Brunswick, New Jersey 08903). Am. J. Phys. 43: No. 1, 29-32 (Jan 1975).

It is shown how one may simply associate the problem of the isotropic oscillator to that of the hydrogenic atom in classical dynamics, particularly in its action–angle variable formulation, so that the solution of the one problem implies that of the other. This relationship persists in the two–dimensional quantum mechanics and provides the key to the construction of a wave packet solution for the isotropic oscillator in the region of large principal quantum number in three dimensions. (auth)

18125 BORN–OPPENHEIMER TYPE WAVEFUNCTIONS AND THE VIRIAL THEOREM FOR H_2^+ AND D_2^+. Eaves, J.O.; Epstein, S.T. (Theoretical Chemistry Institute, University of Wisconsin, Madison, Wisconsin 53706). J. Chem. Phys. 62: No. 1, 299 (1 Jan 1975).

Numerical calculations are presented which confirm earlier order of magnitude estimates of the extent to which the virial theorem is not satisfied by Born–Oppenheimer type wavefunction. (AIP)

18126 RELATIVISTIC EXPRESSION FOR THE ENERGY OF A COMPRESSED ONE-ELECTRON ATOM. Barkauskas, R. E.; Kalade, Yu. A.; Savukinas, A. Yu. (Vilnyus State Univ., USSR). Liet. Fiz. Rinkinys; 14: No. 2, 263-271(1974). (In Russian).

The solution of the Dirac equation for the hydrogen atom and hydrogen-like ions under the boundary condition $d\rho/dr = 0$ for relativistic radial probability density with finite $r = r_0$ is investigated. The case of the boundary condition $j\ (r_0) = 0$ for the relativistic current density is considered as well. The expressions of the energy level shifts for large r_0 (low compression) are obtained. The formulas for the critical ionization radii are presented. (auth)

18127 TOTAL ENERGIES AND RELATIVISTIC CORRECTIONS FOR THE GROUND STATES OF ISOELECTRON HELIUM SERIES (Z = 1 TO 46) WITH HYDROGEN-LIKE NON-RELATIVISTIC AND RELATIVISTIC WAVE FUNCTIONS. Satsuk, V. V.; Tarasov, V. F. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 4, 21-29(1974). (In Russian).

The total energies and relativistic corrections for He-like systems were calculated with different atomic models. The results were compared with data from quantum mechanics calculations and with experimental values. (tr-auth)

18128 INFLUENCE OF ROTATIONAL INELASTIC COLLISIONS ON DIFFUSION. Wahby, A. S. M. Amsterdam; Univ. of Amsterdam (1974). 60p.

Thesis.

The study of the effect of rotational inelastic collisions on diffusion is given. Relative diffusion coefficients were determined in the temperature range from 240 to 420°K for the following gas mixtures: Isotopic hydrogen mixtures H_2-HD and H_2-D_2, and for the hydrogen-helium mixtures ^{4}He-H_2, ^{4}He-D_2, and ^{4}He-Hd. From the determination of the temperature dependence of the diffusion coefficients of HD on one hand and the homonuclear hydrogen molecules H_2 and D_2 on the other in helium-hydrogen and isotopic-hydrogen mixtures, it is concluded that the loaded-sphere model is not applicable. Almost Lorentzian gas mixtures are Ar-H_2, Ar-D_2, Ar-HD, Kr-H_2, Kr-D_2, and Kr-HD. Excellent agreement is obtained between the thermal diffusion factors of these almost Lorentzian mixtures derived from the temperature dependence of the diffusion coefficient and the measurements of Van de Ree et al. on the thermal diffusion factors of the same mixtures. Nitrogen oxide in the rare gases ^{4}He, Ne, Ar, and Kr. Effective potential parameters for the various mixtures were obtained from the measured temperature behavior of the diffusion coefficients. (auth)

18129 THE GROUND STATE PROPERTIES OF SPIN—ALIGNED ATOMIC HYDROGEN, DEUTERIUM, AND TRITIUM. Etters, R.D. (Colorado State University, Fort Collins, Colorado 80521); Dugan, J.V. Jr.; Palmer, R.W. J. Chem. Phys. 62: No. 2, 313-319 (15 Jan 1975).

The bulk, ground-state properties of atomic hydrogen, deuterium, and tritium systems are calculated assuming that all pair interactions occur via the $^3\Sigma^+_u$ atomic triplet potential. The conditions required to obtain this system, including inhibition of recombination through the energetically favorable singlet interaction, are discussed. The internal energy, pressure, and compressibility are calculated over the volume range $40\ \mathrm{cm^3/mole} < V < 200\ \mathrm{cm^3/mole}$ applying the Monte Carlo technique with a quantum mechanical variational wavefunction. The system studied consisted of 32 atoms in a box with periodic boundary conditions. Results show that atomic triplet hydrogen and deuterium remain gasous at 0 K; i.e., the internal energy is positive at all molar volumes considered. Under the same conditions, tritium forms a liquid with a binding energy of $E_0 \simeq -0.75$ K per atom, at a volume of $V \simeq 130\ \mathrm{cm^3/mole}$. The pair distribution function for these systems is also calculated. A brief discussion of the predicted superfluid behavior of $^3\Sigma^+_u$ hydrogen and tritium is presented. (auth)

18130 MONTE CARLO CALCULATIONS FOR PRESSURE DISSOCIATION OF H_2. Aviram, I.; Goshen, S. (Nuclear Research Center—Negev, P.O. Box 9001, Beer—Sheva, Israel); Thieberger, R. J. Chem. Phys. 62: No. 2, 425-432 (15 Jan 1975).

A Monte Carlo method is proposed for the calculation of dissociation of diatomic homonuclear molecules as a function of temperature and density. The procedure is illustrated for hydrogen in the temperature range up to 15000 K. The essentially quantum mechanical processes of dissociation and binding are replaced here by a classical model system of free atoms and molecules whose numbers in the system may vary according to certain probabilistic rules. A choice must be made of the interaction potentials between particles, which are then replaced by equivalent hard—spheres repulsive interactions. The attractive part of the singlet H—H interaction, which is responsible for the bound state of two atoms, is replaced by an intrinsic "binding" energy attributed to each molecule present in the system. Results show that dissociation starts at densities well below the packing density of molecules. (auth)

18131 TOTAL x—RAY SCATTERING BY H_2. Bentley, J.J.; Stewart, R.F. (Department of Chemistry, Carnegie—Mellon University, Pittsburgh, Pennsylvania 15213). J. Chem. Phys. 62: No. 3, 875-878 (1 Feb 1975).

From the Waller—Hartree theory, the total x-ray scattering of H_2 has been calculated with the first 10 natural orbitals of Davidson and Jones. Vibrational averaging has not been included. The calculated intensities differ by as much as 5% from a similar calculation with the Davidson and Jones SCF orbital. The accuracy of the calculations is demonstrated by agreement of $\langle r_{12}^{-1} \rangle$ from Tavard's sum rule with $\langle r_{12}^{-1} \rangle$ values given by Davidson and Jones. The coherent intensities from the first 10 natural orbitals are in close agreement with the SCF results. By correcting the calculated inelastic scattered intensities for relativistic effects, the total scattering intensities from the correlated wavefunction are in excellent agreement with the experimental values of Wollan. Corresponding SCF values are significantly different. The results for molecular hydrogen encourage us to suggest more accurate gas phase measurements of total x—ray scattering by other diatomic molecules in order to determine the two electron expectation $\langle r_{12}^{-1} \rangle$. (auth)

18132 THE PAIRWISE CORRELATED GENERALIZED VALENCE BOND MODEL OF ELECTRONIC STRUCTURE. III. PHOTOIONIZATION OF THE HELIUM ATOM. Wendoloski, J.J. (Sterling Chemistry Laboratory, Yale University, New Haven, Connecticut 06520); Petersson, G.A. J. Chem. Phys. 62: No. 3, 1016-1020 (1 Feb 1975).

The calculation of photoionization cross sections for the helium atom provides a simple but sensitive test of the accuracy of correlated wavefunctions and has been used to evaluate the relative importance of orbital splitting and dynamic electron correlation. We find that; although dynamic correlation has a greater effect on the total energy, orbital splitting has a greater effect on the transition probabilities. However, if we wish to reduce the errors in calculated transition probabilities below 10%, we must include both orbital splitting and dynamic electron correlation. The pairwise correlated generalized valence bond wavefunction, which includes both effects, gives transition probabilities with errors of about 1%. (auth)

18133 DISSOCIATIVE FIELD IONIZATION OF H_2 AND HD. Hanson, G.R. (Department of Physics, The University of Chicago, Chicago, Illinois 60637). J. Chem. Phys. 62: No. 3, 1161-1180 (1 Feb 1975).

Distributions in kinetic energy of the atomic ions resulting from field ionization of H_2 and HD are reported. For fields of 1.4—2.6 V/Å, the distributions of H^+ from HD are characterized by a series of peaks which cannot be ascribed to field-induced resonance states. This structure can be understood by examining the motion of vibrationally excited molecular ions in the high electrostatic field necessary for field ionization during the period immediately following field ionization. The stability of a molecular ion in such fields is a strong function of the angle between the molecular ion axis and the field. Thus, not all molecular ions produced with sufficient vibrational energy to dissociate, if properly oriented, do in fact dissociate in a time comparable to the first one—half vibrational period. Such ions dissociate after a time of the order of (3/2), or (5/2), or (7/2), ..., vibrational periods, depending on the time required for the field to induce rotation of the molecule ion to the unstable orientation. These dissociations, periodic in time, result in periodicities, i.e., peaks, in the kinetic energy distribution of H^+ from HD. Because the energy differences between these peaks vary as the square of the electrostatic field, they can be used as a sensitive method of field calibration. The effect of these molecular processes on the kinetic energy distributions of the other atomic ions resulting from the dissociation of H_2 and HD are discussed. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstract 18497.

18134 (JINR-P1-8205) EMISSION OF THE AUGER ELECTRONS IN μ-MESIC ATOMS AND ESCAPE OF CHARGED PARTICLES IN μ^--MESON CAPTURE BY LIGHT (C, N, O) AND HEAVY (Ag, Br) NUCLEI. Batusov, Yu. A.; Bunyatov, S. A.; Vizireva, L.; Gulkanyan, G. R.; Mirsalikhova, F.; Sidorov, V. M.; Chernev, Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The probabilities of emission of the Auger electrons of (20 to 100) keV in μ-mesic atoms of light (C, N, O) and heavy (Ag, Br) elements were determined to be $\alpha^l = (1.1 \pm 0.3) \cdot 10^{-2}$ and $\alpha^h = (31 \pm 1) \cdot 10^{-2}$ respectively. The multiplicity was also determined, and the spectrum of the Auger electrons from heavy element mesic atoms was measured. There were obtained the relative probabilities of emission of one, two, three and four charged particles in μ^--meson capture by (C, N, O) and (Ag, Br) nuclei. The total yield of charged particles per one capture act is $(7.4 \pm 1.4)\%$ for (C, N, O) and $(2.9 \pm 0.2)\%$ for (Ag, Br) nuclei. (auth)

18135 TESTS FOR RESONANCE STATES IN THE POSITRON—HYDROGEN SYSTEM ABOVE THE PICKUP THRESHOLD. Hahn, Y. (Department of Physics, University of Connecticut, Storrs, Connecticut 06268). Phys. Rev. A 10: No. 6, 2512-2515 (Dec 1974).

Difficulties in the theoretical calculation of possible resonance states above the pickup but below the first hydrogen excitation threshold in the positron—hydrogen scattering system are discussed. A series of tests, are proposed which should help avoid certain conceptual and practical difficulties one encounters in the analysis. Existing theoretical calculations claiming resonance states are critically examined, and it is concluded that there is as yet no evidence for the presence of such resonance states in this particular energy region. (auth)

18136 ANALYTICAL CALCULATION TO ALL ORDERS IN $Z\alpha$ OF VACUUM POLARIZATION AT SHORT DISTANCES. Brown, L.S.; Cahn, R.N.; McLerran, L.D. (Physics Department, University of Washington, Seattle, Washington 98195). Phys. Rev. Lett. 33: No. 26, 1591-1593 (23 Dec 1974).

We have calculated the leading terms of the potential due to vacuum polarization about a point nucleus, $V(r) = m[a_{-1}(mr)^{-1} + a_0 + a_1(mr) + a_{2\lambda}(mr)^{2\lambda}]$. Our results for a_1 and $a_{2\lambda}$, to all orders in $Z\alpha$, extend the previously known results which included terms only up to $(Z\alpha)^3$. For a_{-1} we confirm previous results. The new portions of a_1 and $a_{2\lambda}$ do not remove present discrepancies in muonic x–ray transition such as 5g→4f in ^{208}Pb. (auth)

18137 ENERGY LEVELS OF A CHARGED PARTICLE IN THE FIELD OF A SPHERICALLY SYMMETRIC UNIFORM CHARGE DISTRIBUTION. Zablotney, J. (305 Knoll Street, Vienna, Virginia 22180). Am. J. Phys. 43: No. 2, 168-172 (Feb 1975).

The non–relativistic energy spectrum for a negatively charged particle in the field of a spherically symmetric charge distribution is obtained. A complete solution is found which includes a representation of the wavefunction exterior to the charge distribution. The energy eigenvalues are found from the matching condition at the boundary of the nucleus and the energy levels for a mu meson in the field of a lead nucleus are calculated. (auth)

Collision Phenomena

Refer also to abstracts 16705, 18098, 18135, 18176, 18344, 18346, 18666, and 19133.

18138 (AD-781282) OPTICAL PUMPING STUDIES OF COLLISIONAL INTERACTIONS. Final Scientific Report. Franz, F. A. (Indiana Univ., Bloomington (USA). Dept. of Physics). 25 May 1974. 24p. (AFOSR-TR-74-0987). NTIS $3.00.

A final scientific report is given on a project involving application of optical pumping techniques to studies of atomic collisions. Magnetic depolarization, nuclear spin efforts, collisional selection rules, surface interactions, and quenching collisions are particularly emphasized. (auth)

18139 (AD-781610) COLLISIONAL EXCITATION OF NITROGEN BY LOW-ENERGY ELECTRONS TO THE SECOND POSITIVE (C TRIPLET Pi(U)). Ader, S. W.; Doerner, W. C. (Naval Postgraduate School, Monterey, Calif. (USA)). Jun 1974. 29p. NTIS $4.50.

Thesis.

An experiment was conducted to determine the effective excitation cross sections for forming the c triplet Pi(U) 2nd positive state of N2 in the lowest vibrational energy level by bombarding gaseous nitrogen with electrons in the energy range 80 to 900 eV. When the nitrogen was bombarded by 250 eV electrons the effective cross section was determined to be (1.72 plus or minus .22) × 10 to the -17th power sq cm. which was the maximum value of the cross section measured. (auth)

18140 (JINR-P4-8231) ORBITING OSCILLATIONS IN THE TOTAL CHARGE EXCHANGE CROSS SECTION. Matveenko, A. V.; Ponomarev, L. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The reaction of the proton charge exchange on hydrogen atoms in the region of collision energies of $10^{-2} \leq E \leq 0.7$ eV was calculated in detail. In the total charge exchange cross section there were observed the oscillations with the amplitude of about 0.1 from the average cross section value. It was established that oscillation structure of the cross section is explained by orbiting near the peak of the centrifugal barriers of the effective potentials of the problem. The phase analysis of the charge exchange cross section was performed. (auth)

18141 (ORO-2972-279, pp 66-69) SOLID STATE ELECTRONIC STRUCTURE EFFECTS OF OXYGEN IN HIGHLY IONIZED MOLECULES. 1974.

In annual report, 1974.

18142 (ORO-2972-279, pp 74-84) AUGER ELECTRON DECAY OF ATOMS (e.g. Ne AND Ar) AND SIMPLE GASEOUS MOLECULES (e.g. N_2 AND O_2) EXCITED BY PROTON, ALPHA PARTICLE AND HEAVY-ION BOMBARDMENT. 1974.

In annual report, 1974.

18143 (ORO-2972-279, pp 85-92) RADIATIVE DECAY OF MULTIPLY-IONIZED TARGET GASES. 1974.

In annual report, 1974.

18144 SURFACE AND VACUUM PHYSICS INDEX. Volume 9, No. 10, 1974. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dolumentation (1974). 65p.

18145 ELECTRON-IMPACT VIBRATIONAL EXCITATION OF H_2O. Itikawa, Y. (Tokyo Univ.). J. Phys. Soc. Jap.; 36: No. 4, 1127-1132(Apr 1974).

Cross sections for excitations of the three fundamental vibrational modes of H_2O by electron collisions are calculated with the use of the Born theory for the collision energies from the threshold to 100 eV. Electron-molecular multipole (dipole and quadrupole) interactions, as well as polarization force, are taken into account. The dominance of the quadrupole interaction relative to the dipole one prevents the cross section from falling rapidly as the energy increases, resulting in a fairly large cross section even in the high energy range ($\gtrsim$10 eV). Differential cross sections are also calculated at 1, 15, and 53 eV. For the latter two incident energies, a comparison is made with the relative differential cross section measured by Trajmar et al. (auth)

18146 γ-RADIATION-INDUCED AIR GLOW. .Zhemerev, A. V.; Medvedev, Yu. A.; Stepanov, B. M.; Trukhanov, G. Ya. Sov. At. Energy (Engl. Transl.); 35: No. 6, 1145-1146(Dec 1973).

Translated from At. Energ. (USSR); 35: No. 6, 438-439(Dec 1973).

The characteristics of the light flash which is excited by a gamma quantum pulse in air were investigated. Both the delay of the light signal within the irradiated region and the self-absorption of the light were taken into consideration. The time dependence of the intensity of the light flux was determined for gamma fluxes of various intensities. The conditions under which the self-absorption effect is immaterial were determined. (JFP)

18147 CLASSICAL TRAJECTORY TREATMENT OF INELASTIC SCATTERING IN COLLISIONS OF H^+ WITH H_2, HD, AND D_2. Giese, C.F. (Tate Laboratory of Physics, School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455); Gentry, W.R. Phys. Rev. A 10: No. 6, 2156-2173 (Dec 1974).

A semiclassical model for vibrational excitation in molecular collisions is proposed, in which three–dimensional classical trajectory calculations are used to evaluate the quantum vibrational transition probabilities. Using an accurate analytic fit to 138 ab initio points in the important region of the $H^+{}_3$ potential surface and a new Monte Carlo interpolation method for averaging over initial conditions, we apply the model to vibrational excitation in collisions of H^+ with H_2, HD, and D_2. The calculations reveal the necessity of correcting our previously reported experimental vibrational transition probabilities for rotational contributions. Once this is done, the experimental data and the model calculations are in very good agreement. The theoretical results support our previous conclusion that vibrational excitation in this system is caused primarily by dilution of the molecular bond by the passing proton. The observed maximum in the experimental inelastic differential cross sections at approximately half the rainbow angle is shown to be associated with the second classical rainbow, which results from the anisotropy of the potential. (auth)

18148 ANGULAR DISTRIBUTION OF ELECTRONS FROM COLLISIONALLY PRODUCED AUTODETACHING STATES OF H^-. Risley, J.S.; Geballe, R. (Department of Physics, University of Washington, Seattle, Washington 98195). Phys. Rev. A 10: No. 6, 2206-2217 (Dec 1974).

The angular distributions of electrons emitted in the decay of the autodetaching $(2s^2)\ ^1S$, $(2s2p)\ ^3P$, $(2p^2)\ ^1D$, and $(2s2p)\ ^1P$ states of H^- have been measured from 10° to 150° for collisions of H^- on He, Ar, and H_2 between 100 eV and 10 keV. The intensity of the $(2s^2)\ ^1S$ line, in the "rest" reference frame of H^-, was isotropic for high collision energies. For low–energy collisions the distribution has a component which is asymmetric about 90° and peaked at forward angles. The intensity of the $(2s2p)\ ^3P$ line, observed only in high–energy collisions, was approximately isotropic. The intensity of the unresolved $(2p^2)\ ^1D$ and $(2s2p)\ ^1P$ lines, for collisions above 1 keV, was symmetric about 90° exhibiting a $(1 + C\cos^2\theta)$ behavior with angle. For lower collision energies, the angular distribution of the unresolved $(2p^2)\ ^1D-(2s2p)\ ^1P$ lines became asymmetric. The results are interpreted in terms of the orientation of the excited H^- state. We discuss the effect of interference between discrete and continuum states and the effect of molecular distortion due to the target atom on the measured angular distribution. (auth)

18149 X–RAY PRODUCTION IN HEAVY–ION–ATOM COLLISIONS: $3d\sigma$ AND $4f\sigma$ ELECTRON PROMOTION. Fortner, R.J. (Lawrence Livermore Laboratory, Livermore, California 94550). Phys. Rev. A 10: No. 6, 2218-2231 (Dec 1974).

In this paper, a systematic study of x–ray production in ion–atom collisions is presented for electron promotion by both $3d\sigma$ and $4f\sigma$ molecular orbitals. L x–ray production cross sections and high–resolution L x–ray spectral measurements are presented for P^+, S^+, Cl^+, Ar^+, and K^+ projectiles incident on Ar and CH_4 gas targets for projectile energies between 15 and 200 keV. Average values of the fluorescence yield and total L–shell ionization cross sections are determined. A dramatic Z dependence observed in the x–ray production cross section is attributed to changes in fluorescence yield. Theoretical calculations of fluorescence yield are found not to agree with experimentally determined values. Finally, inner–shell vacancy production by $3d\sigma$ electron promotion is found to be much less efficient than $4f\sigma$ electron promotion for the collision systems studied in this paper. (auth)

18150 MULTICHANNEL EIKONAL TREATMENT OF ATOMIC COLLISIONS: THE $2\,^1S$ AND $2\,^1P$ INELASTIC SCATTERING OF ELECTRONS BY HELIUM. McCann, K.J.; Flannery, M.R. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). Phys. Rev. A 10: No. 6, 2264-2272 (Dec 1974).

A multichannel eikonal treatment of atomic collisions is presented and applied to the excitation of atomic helium by electrons with incident energy E in the range $50 \leq E \leq 500$ eV. Two different sets of orthogonal wave functions are employed. A four–channel description yields differential and total excitation cross sections in satisfactory agreement with experiment. (auth)

18151 MEASUREMENTS OF ELECTRON–DETACHMENT CROSS SECTIONS FROM O^- AND S^-. Comer, J.; Schulz, G.J. (Department of Engineering and Applied Science, Mason Laboratory, Yale University, New Haven, Connecticut 06520). Phys. Rev. A 10: No. 6, 2100-2106 (Dec 1974).

Electron–detachment cross sections have been measured for collisions of a negative–ion beam with a target gas. The systems studied are O^- on CO, H_2, O_2, N_2, CO_2, NO, He, C_2H_2, C_2H_4, and CH_4 along with S^-on H_2, O_2, and CO. These cross sections have been measured in the range of incident ion energies from 0.5 to 20 eV. Some cross sections exhibit an onset near the threshold for direct detachment, while others have a large cross section below the threshold for direct detachment. The latter cross sections can be attributed to an associative detachment process. (auth)

18152 INELASTIC–SCATTERING CROSS SECTIONS FOR Li^+ ON He: THE ADIABATIC MOLECULAR MODEL. Junker, B.R. (Department of Physics and Astronomy, University of Georgia, Athens, Georgia 30601); Browne, J.C. Phys. Rev. A 10: No. 6, 2078-2086 (Dec 1974).

In this paper are reported ab initio computed cross sections for the two lowest charge–transfer channels and the lowest excitation channel for the system Li^+ scattered from He. The computations are carried out in completely ab initio fashion in the adiabatic molecular basis. The molecular potential curves and wave functions were computed by use of standard variational procedures. The coupling matrix elements between the molecular states are used in a classical trajectory formulation of the nuclear motion problem to obtain cross sections for the inelastic processes. The differential cross sections agree well with the experimental results of Lorents and Conklin and of Francois, Dhuicq, and Barat. The role of radial coupling in determining the charge–exchange cross sections is stressed. (auth)

18153 EXCITATION OF LOW EXCITED STATES OF Ne I AND He I BY He^+ + Ne COLLISIONS. Isler, R.C. (Department of Physics, University of Florida, Gainesville, Florida 32611). Phys. Rev. A 10: No. 6, 2093-2099 (Dec 1974).

Emission cross sections for the resonance lines of Ne I (744 and 736 Å) and He I (584 Å) have been investigated during collisions of He^+ + Ne at energies from threshold to 9 keV. The threshold of excitation for the channel which dissociates into the upper state of the 736–Å line is 21.7 ± 2.0 eV, and the large modulation depth in the total cross section shows this channel to be strongly coupled at an internuclear separation of 5.3 Å to another excited channel which is presumed to be He^* (1s2s) + $Ne^+(2p^5)$. The onset of excitation of the 744–Å line occurs at 16.3 ± 0.5 eV, and the emission cross section exhibits oscillatory structure which is less pronounced than that of the 736–Å line. Excitation of the 584–Å line appears to occur through several channels. (auth)

18154 IONIZING COLLISIONS OF CESIUM WITH Cl_2, Br_2, AND I_2. Tang, S.Y.; Leffert, C.B.; Rothe, E.W. (Research Institute for Engineering Sciences and Department of Chemical Engineering, Wayne State University, Detroit, Michigan 48202); Reck, G.P. J. Chem. Phys. 62: No. 1, 132-135 (1 Jan 1975).

A crossed molecular beam apparatus is used to study ionizing collisions of energetic cesium atoms with Cl_2, Br_2, and I_2. The cross sections for formation of Cs^+ are reported in the near–threshold region. The experiment combines an energy resolution better than 0.1 eV (FWHM) with a deconvolution procedure. An electron affinity of 2.50 eV is deduced for all three halogens, in good agreement with previous work. In a separate experiment, with cesium energies from threshold to 350 eV, and with much poorer energy resolution, the intensity ratios X^-/X^-_2 are obtained. The results can be reasonably explained with an electron jump model. At energies below 30 eV, the observed ratios are in agreement with two other investigators, but between 150–350 eV they are drastically different from work reported from a third. Complementary data recently reported by a fourth group are difficult to reconcile with the present results. (auth)

18155 IN–OUT DECOMPOSITION FOR INELASTIC COLLISIONS AS SUBDYNAMICS. III. PERTURBATION THEORY AND THE SEMICLASSICAL LIMIT. Shipsey, E.J. (Department of Physics, University of Texas, Austin, Texas 78712). J. Chem. Phys. 62: No. 1, 30-33 (1 Jan 1975).

A new representation for the subdynamics is given such that the resultant coupling matrix becomes identical with the semiclassical expression away from turning points. A perturbation theory is developed which also reduces to semiclassical theory away from the turning points. The subdynamic perturbation expression is therefore capable of making up for the deficiencies of the semiclassical theory at the turning points. A numerical illustration is given. (auth)

18156 MOLECULAR BEAM INVESTIGATION OF THE EFFECT OF INNER–SHELL ELECTRONS IN MOLECULAR COLLISIONS. Winicur, D.H.; Fraites, J.L. (Chemistry Department and the Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). J. Chem. Phys. 62: No. 1, 63-68 (1 Jan 1975).

Differential elastic scattering cross sections were obtained at thermal energies using crossed molecular beams for metastable Kr^*, Ar^*, Ne^*, and He^* scattered by ground–state krypton. Potential well depths are calculated from the location of the observed rainbow maxima and are compared to those for the analogous alkali atoms Rb, K, Na, and Li scattered by krypton. The effect of the inner–shell electrons on molecular collisions is deduced. At high electron shell levels, the $(n-1)$ electron decreases the strength of the interaction during a collision; whereas, at low shell levels, the interaction strength is increased by the $(n-1)$ electron. *s* and *p* electrons are shown to affect the interaction strength differently at the lowest shell level. (auth)

18157 COMMENT ON ROTATIONAL AND VIBRATIONAL EXCITATION OF H_2 BY ELECTRON IMPACT. Chang, E.S. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01002). Phys. Rev. Lett. 33: No. 27, 1644-1647 (30 Dec 1974).

Recently Wong and Schulz have extended previous angular distribution measurements on $e-H_2$ scattering to higher vibrational states with resolution of rotational energy levels. I apply a previous theory to compute these angular distributions, and show how they can be easily understood in terms of the body–frame phase shifts and their derivatives. (auth)

18158 X–RAY PRODUCTION CROSS SECTIONS, INTENSITY RATIOS, AND CENTROID ENERGY SHIFTS OF Ag K AND L AND Au L x RAYS PRODUCED BY ^{16}O BEAMS OF 12–50 MeV. Bissinger, G. (East Carolina University, Greenville, North Carolina 27834); Nettles, P.H.; Shafroth, S.M.; Waltner, A.W. Phys. Rev. A 10: No. 6, 1932-1937 (Dec 1974).

The 12–50–MeV ^{16}O beam–induced K and L x rays of Ag and the L x rays of Au from thin targets were studied with a Si(Li) detector. Absolute K and L x–ray production cross sections were derived from measured x–ray yields and compared to available theoretical calculations for inner–shell Coulomb ionization cross sections. Inclusion of Coulomb repulsion, binding, and $(Z_1/Z_2)^3$ effects in the plane–wave Born–approximation calculations gives good agreement with experimental values of σ_{KX} for Ag. The agreement between theory and experiment for L–shell ionization is not so good, possibly due to the effects of multiple ionization on the fluorescence yield, although the energy dependence of σ_{LX} for Au is well reproduced. The energies of the Ag $K\alpha$ and $K\beta$ and Au $L\alpha$, $L\beta$, and $L\gamma$ lines were observed to change with beam energy as did the intensity ratios of these lines. HFS calculations for the Ag $K\alpha$ and $K\beta$ lines indicate that the observed shifts are probably associated with multiple M–, not L–, shell ionization. (auth)

18159 QUASIMOLECULAR–STATE INTERFERENCE STUDIES: COLLISIONS BETWEEN IONS RANGING FROM Li^+ TO Al^+ AND Ne ATOMS. Andersen, T.; Kirkegaard Nielsen, A.K.; Olsen, K.J. (Institute of Physics, University of Aarhus, DK–8000 Aarhus C, Denmark). Phys. Rev. A 10: No. 6, 2174-2186 (Dec 1974).

A systematic investigation of the interference of energetically neighboring quasimolecular terms giving rise to oscillatory structure in the total cross sections for diabatic processes has been performed by optical studies of selected spectral lines produced in ion–atom collisions. All ions ranging from Li^+ to Al^+ have been used as projectiles with energies varying from 0.1 to 15 keV using Ne as the target. Interference between direct–excitation and charge–exchange collision channels leading to regularly spaced oscillations which are 180° out of phase have been seen in the N^+-Ne, O^+-Ne, Na^+-Ne, and Mg^+-Ne systems. The behavior of the oscillations present in the total emission cross sections for the 3p levels in Ne cannot be accounted for by the theoretical predictions by Ankundinov et al. Strong polarization effects have been seen in the optical radiation from the $3p'\,(3/2)_1$ level in Ne in all systems and for the $[\frac{3}{2}]_1$ level in Mg in the Mg^+-Ne system. The oscillations in the Ne excitation function are mainly due to the polarization component of the radiation perpendicular to the beam direction for the N^+-Ne, O^+-Ne, and Na^+-Ne systems, whereas the parallel component also plays a dominant role in the Mg^+-Ne system. The molecular–orbital (MO) model is used to account for the polarization data. (auth)

18160 DIMENSIONALITY CONTROL OF COUPLED SCATTERING EQUATIONS USING PARTITIONING TECHNIQUES: THE CASE OF TWO MOLECULES. Englot, G.F.; Rabitz, H. (Department of Chemistry, Princeton University, Princeton, New Jersey 08540). Phys. Rev. A 10: No. 6, 2187-2205 (Dec 1974).

A method of variable reduction of the dimensionality of the coupled equations for inelastic scattering is presented. The method is based upon a projection operator P with restricted ranges of values for the orbital angular momentum and coupled rotational angular momenta of the two molecules. For rotational states restricted by $0 \leq j_1 \leq j_1{}^*$ and $0 \leq j_2 \leq j_2{}^*$ and total angular momentum large, the coupled equations have dimensionality $2(j_1{}^* + 1)(j_2{}^* + 1) - 1 \leq N \leq (j_1{}^* + 1)^2 (j_2{}^* + 1)^2$, where N is controlled by the choice of P. This is in contrast to conventional partitioning techniques which utilize further restrictions on the important molecular rotational states. In both cases the well-known parity conservation causes blocking of the equations into two sets, each of which is essentially half the size of the original set. The dynamics in the P subspace and its complementary Q subspace are decoupled by various approximations on the equation of motion of $Q\psi_{scat}$. Information about scattering into the Q subspace is retained within these approximations and is reintroduced at the end of the computation with little additional labor. An expression for the error in the calculation of the resultant approximate reactance operators is derived and its implications are discussed. The general formal equations are then applied to the case of scattering of two rigid rotors, although the inclusion of vibrational modes would in no way affect the procedures outlined. Various possible choices for P are presented, and additional constraints on P for the case of two indistinguishable molecules are discussed. A method of solution for the $P\psi_{scat}$ equation is suggested, and it is shown to lead to the possibility of substantial savings in computational labor. (auth)

18161 ROLE OF RESONANCES IN THE ELECTRON-IMPACT EXCITATION FUNCTIONS OF THE C $^3\Pi_u$ AND E $^3\Sigma^+{}_g$ STATES OF N_2. Golden, D.E.; Burns, D.J.; Sutcliffe, V.C. Jr. (Behlen Laboratory of Physics, University of Nebraska, Lincoln, Nebraska 68508). Phys. Rev. A 10: No. 6, 2123-2130 (Dec 1974).

Resonances in $e^- - N_2$ scattering have been studied from about 11 to 16 eV by simultaneous measurement of the transmitted electron spectrum, and both the prompt and delayed emission functions for the C $^3\Pi_u \rightarrow$ B $^3\Pi_g(0,0)$ transition. In this energy domain 28 structures have been observed, 25 of which have been observed in both the electron transmission spectrum and the total optical excitation function. The delayed emission in this energy range is attributed to the decay of the various states of $N^-{}_2$ to the E $^3\Sigma^+{}_g$ state of N_2 which is collisionally de-excited to the C $^3\Pi_u$ state of N_2. Negative-ion resonances which decay to both the E $^3\Sigma^+{}_g$ and C $^3\Pi_u$ contribute strongly to the 3371 emission in this energy domain. (auth)

18162 DISSOCIATION OF FLUORINE MOLECULES BY ELECTRON IMPACT. Belenov, E.M.; Isakov, V.A.; Oraevskii, A.N.; Romanenko, V.I. (P. N. Lebedev Physics Institute, USSR, Academy of Sciences). Sov. J. Quantum Electron. 4: No. 6, 758-760 (Dec 1974).

It is shown that the efficiency of the dissociation of electronegative gas molecules increases considerably in an external electric field. (auth)

18163 DOUBLE CHARGE TRANSFER SPECTROSCOPY: SEPARATION OF THE MULTIPLET TERMS OF Xe^+ AND Xe^{++} PRODUCED BY H^+ + Xe COLLISION. Fournier, P.; Benoit, C.; Durup, J.; March, R. E. (Paris Univ.). Compt. Rend., Ser. B; 278: No. 24, 1039-1041(10 Jun 1974). (In French).

The special levels Xe^+ and Xe^{++} produced by double charge transfer in collisions of fast H^+ ions on Xe atoms are identified by measurement of the energies of translation of the H^- ions produced. Certain of the transit ions observed imply a change of total spin. A relative predominance of J-maximum terms is also observed. (auth)

18164 SURVEY OF SATELLITE AND GROUND BASED MEASUREMENTS OF PHOTOELECTRON EXCITED EMISSIONS. Carlson, H. C. (Univ. of Texas, Dallas). Ann. Geophys.; 30: No. 1, 59-69(Jan 1974).

From 2nd general scientific assembly of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The study of airglow emissions excited by photoelectron impact holds the potential to improve knowledge of: upper neutral atmospheric concentrations and compositions; solar flux variations; photoelectron fluxes, their production and loss; and/or relevant cross sections. Recent progress toward the realization of this potential is reviewed, noting the large number of relevant emission lines identified to date, and the geophysical contributions that have followed from interpretation of these observations. Recent developments bearing on work with photoelectron impact excited $0(^1D)$ emissions are discussed in particular detail. Limitations on the ability to remove background components of $0(^1D)$ emission (particularly uncertainties in defining the dissociative recombination component) are discussed. Also noted are recent identifications of photoelectron impact excited emissions sought on the basis of variation with time, altitude, and latitude. (auth)

18165 RESONANCES AND ANTIRESONANCES IN THE TOTAL CROSS SECTION FOR THE ELECTRON EXCITATION OF CADMIUM LEVELS. Zapesochnyi, I. P.; Sovter, V. V.; Shpenik, O. B.; Zavilopulo, A. N. (Uzhgorod State Univ., USSR). Dokl. Akad. Nauk SSSR; 214: No. 6, 1288-1290(21 Feb 1974). (In Russian).

The behavior of the excitation cross section of four spectral lines of Cd close to the threshold of the process, the upper energy levels of which were 5^1P_1, 6^3S_1, 7^3S_1, and 5^3D_{123}, were studied in detail under experimental conditions in which the electron beam in the collision volume was no more than 2×10^{-8} amp, the pressure of the Cd vapor was less than 5×10^{-3} torr, and the energy spread of the electron beam was 0.08 eV. A detailed analysis of the curve of the energy dependence of the excitation cross section of the spectral lines showed the existence of resonance in all four levels and the existence of two antiresonances in the 5^1P_1 level. It is assumed that competition of two elementary processes occur—excitation of the Cd atoms to the 5^1P_1 state and formation of those states of negative Cd ion whose decay supplements the population of the excited triplet states. Essentially this competition occurs in a very narrow range of relative rates of the interaction of electrons with Cd. (JSR)

18166 EVIDENCE FOR A MOLECULAR *J-J* COUPLING SCHEME FOR KI NEUTRAL POTENTIALS. Carter, G.M.; Pritchard, D. (Research Laboratory of Electronics and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). J. Chem. Phys. 62: No. 3, 927-931 (1 Feb 1975).

We have measured the differential probability of electron spin depolarization for scattering polarized potassium from atomic iodine with several different orientations of the axis of quantization relative to the collision axes. No dependence on this orientation was found, contrary to the predictions of our model for spin depolarization when a strong coupling of the electron spin to the internuclear axis is present during the collision. Consequently, we conclude that the coupling scheme for the lowest neutral states of the KI molecule involves predominantly a coupling of the total electronic spin of the potassium and the total electronic spin of the iodine. (auth)

18167 SEMICLASSICAL COLLISION THEORY. APPLICATION OF MULTIDIMENSIONAL UNIFORM APPROXIMATIONS TO THE ATOM-RIGID-ROTOR SYSTEM. Kreek, H.; Ellis, R.L.; Marcus, R.A. (Department of Chemistry, University of Illinois, Urbana, Illinois 61801). J. Chem. Phys. 62: No. 3, 913-926 (1 Feb 1975).

The multidimensional Bessel and Airy uniform approximations developed earlier in this series for the semiclassical *S* matrix are applied to the atom rigid-rotor system. The need is shown for (a) using a geometrical criterion for determining whether a stationary phase point (s.p.pt) is a maximum, minimum, or saddle point; (b) choosing a proper quadrilateral configuration of the s.p. pts. with the phases as nearly equal as possible; and (c) choosing a unit cell to favor near-separation of variables. (a) and (b) apply both to the Airy and to the Bessel uniform approximations, and (c) to the Bessel. The use of a contour plot both to understand and to facilitate the search in new cases is noted. The case of real and complex-valued stationary phase points is also considered, and the Bessel uniform-in-pairs approximation is applied. Comparison is made with exact quantum results. As in the one-dimensional case, the Bessel is an improvment over the Airy for "$k = 0$" transitions, while for other transitions they give similar results. Comparison in accuracy with the results of the integral method is also given. As a whole, the agreement can be considered to be reasonable. The improvement of the present over various more approximate results is shown. (auth)

18168 COMPREHENSIVE OPTICAL AND COLLISION DATA FOR RADIATION ACTION. II. Ar. Eggarter, E. (Department of Physics, University of Chicago, Chicago, Illinois 60637). J. Chem. Phys. 62: No. 3, 833-847 (1 Feb 1975).

We present a complete set of optical oscillator strengths and electron impact cross sections for argon gas. The cross sections were obtained utilizing a semiempirical method of Platzman which stresses the close relationship between photoabsorption and fast electron-atom collisions. The data evaluation was done by analyzing a great variety of experimental measurements of various nature and piecing them together on the basis of theory, with the constraints of sum rules. The mean energy per ion pair, *W*, calculated from adopted cross sections allowing for inner shell contributions is 26.9 eV. This value is expected to exceed the measured value of 26.4 eV, which is reduced by the contribution of collateral ionization. (auth)

18169 COMPREHENSIVE OPTICAL AND COLLISION DATA FOR RADIATION ACTION. I. H_2. Gerhart, D.E. (Department of

Physics, University of Chicago, Chicago, Illinois 60637). J. Chem. Phys. 62: No. 3, 821-832 (1 Feb 1975).

We apply a multistep program of Platzman to construct a complete set of inelastic cross sections for electron scattering at all incident energies. The initial step constructs a complete spectrum of optical oscillator strengths from photoabsorption and other optical data subjected to the constraint of sum rules. Measured cross sections for nonionizing collisions are then adjusted to fit Bethe's formula. Experimental differential ionization cross sections are analyzed by a new method of Kim's. The resulting set of all inelastic cross sections is subjected to the Inokuti—Kim—Platzman sum rule. The value of *W*, the mean energy per ion pair, is calculated from the adopted cross sections and compared with experiment, taking into account dissociation and recombination processes. (auth)

18170 COMPLEX—VALUED CLASSICAL TRAJECTORIES FOR TUNNELING AND WELL—DEFINED PATHS. George, T.F. (Department of Chemistry, The University of Rochester, Rochester, New York 14627). J. Chem. Phys. 62: No. 2, 750-752 (15 Jan 1975).

A paper by Hirschfelder, Christoph, and Palke has suggested analogies between quantum streamlines and complex—valued classical trajectories in a semiclassical treatment of tunneling in reactive molecular collisions. This Comment points out that there are basic differences between trajectories and the streamlines and that care must be taken in attaching any physical significance to complex-valued trajectories or in relating them to quantum mechanical quantities such as streamlines. (AIP)

18171 INELASTIC SCATTERING IN ATOM—DIATOMIC MOLECULE COLLISIONS. II. EFFECT OF ROTATION ON VIBRATIONAL TRANSITION. Stallcop, J.R. (Ames Research Center, NASA, Moffett Field, California 94035). J. Chem. Phys. 62: No. 2, 690-695 (15 Jan 1975).

Rotational and vibrational transitions in a diatomic molecule caused by collisions with an atom are analyzed by a semiclassical method for conditions where the rotational transitions can be handled well by the sudden approximation and the vibrational transitions belong to the adiabatic regime. The contribution to the vibrational transition probability from the correction, which takes the finite value of the spacing between rotational energy levels into account, is examined. (auth)

18172 THEORY OF ANGULAR MOMENTUM DECOUPLING APPROXIMATIONS FOR ROTATIONAL TRANSITIONS IN SCATTERING. Secrest, D. (School of Chemical Sciences, University of Illinois, Urbana, Illinois 61801). J. Chem. Phys. 62: No. 2, 710-719 (15 Jan 1975).

A systematic method is discussed for decoupling the internal angular momentum of molecules involved in a collision from their relative angular momentum. This leads to a large class of rotational approximations of varying degrees of complexity and accuracy. These approximations may be used directly for computing rotational transitions, or they may be used for reducing the rotational complexity involved in accurate vibrational calculations. It is shown how this approach may be used to study the infinite—order sudden approximation and how that approximation may be extended to more complex potentials. It is shown also how one may use results of the j_z—conserving approximation to obtain more complete information on the scattering matrix. The present approach may be used to deduce new angular momentum decoupling approximations and analyze such approximations arrived at through other considerations. (auth)

18173 ENERGY DEPENDENCE OF HIGH RESOLUTION INTEGRAL—COLLISION—CROSS—SECTION MEASUREMENTS FOR ELASTIC SCATTERING OF H AND D ATOMS BY Hg AT THERMAL ENERGIES. Schutte, A.; Bassi, D.; Tommasini, F. (Istituto di Scienze Fisiche dell'Univerisità, 16132 Genova, Italy); Scoles, G. J. Chem. Phys. 62: No. 2, 600-605 (15 Jan 1975).

High-resolution measurements of the energy dependence of the integral collision cross section for the elastic scattering of H and D atoms by Hg at thermal energies are presented, and the experimental setup is described. Evidence for resonant scattering due to quasi-bound states is obtained. The results are compared with the predictions of a potential obtained from spectroscopic data, after averaging the calculated cross sections over experimental parameters. Modifying the potential in the transition region, between the wall and the long—range part, improves the agreement between the results and the predictions of the spectroscopic potential in the region of the resonance. The new potential also slightly improves the agreement between energy level predictions and spectroscopic data. (auth)

18174 COUPLED—STATES APPROACH FOR ELASTIC AND FOR ROTATIONALLY AND VIBRATIONALLY INELASTIC ATOM—MOLECULE COLLISIONS. McGuire, P. (Max—Planck—Institut für Strömungsforschung, 34 Göttingen, Germany). J. Chem. Phys. 62: No. 2, 525-534 (15 Jan 1975).

The elastic and inelastic collisions of an atom with a diatomic molecule are treated quantum mechanically in the body—fixed coordinate system. The body—fixed equations of motion are first compared with the usual spaced—fixed "close—coupling" equations and limiting cases are considered in which the two formalisms become equivalent. The recently developed "coupled—states" approximation in the body—fixed system is then described in which intermultiplet transitions are neglected, and the eigenvalue of the orbital angular momentum operator $\hat{l}^2$ is approximated by $\hbar l\ (l + 1)$. Numerically computed cross sections from this approximation are compared to those computed from the standard space—fixed close—coupling equations for the test system He$-$H$_2$. Agreement to within a few percent is obtained for the integral as well as for the differential cross sections for elastic and for rotationally and vibrationally inelastic scattering in the energy range of 0.9 to 4.2 eV. A coupled—states large-basis calculation (j = 0, 2, 4, 6, 8, 10 for $n = 0$ and j = 0, 2, 4, 6 for $n = 1$) at 4.2 eV is presented which demonstrates the enormous utility of the method. (auth)

18175 CALCULATION OF RADIAL COUPLINGS IN COLLISION OF SLOW ATOMS. Riera, A. (Universidad Autónoma de Madrid, Facultad de Ciencias, Canto—Blanco, Madrid); Salin, A. J. Chem. Phys. 62: No. 3, 1195-1196 (1 Feb 1975).

A method, similar to the Born—Oppenheimer approximation for bound molecular states, is developed for the calculation of radial coupling matrix elements. (AIP)

Atomic Theory

Refer also to abstracts 18126, 18127, and 18662.

18176 (AD—783260) INVESTIGATIONS INTO THE ELECTRONIC STRUCTURE OF ATOMS AND MOLECULES BY SCATTERING TECHNIQUES. Final Scientific Report, 1 February 1970—31 December 1973. Bonham, R. A. (Indiana Univ., Bloomington (USA). Dept. of Chemistry). 31 Dec 1973. 8p. (AFOSR-TR—74-0979). NTIS $3.00.

The topics discussed are electron impact spectra, compton profiles, electron scattering, electronic states, cross sections, and electron density. (JFP)

18177 ATOMIC MULTIQUANTUM TRANSITION CALCULATIONS WITH MODEL POTENTIAL. Manakov, N. L.; Ovsyannicov, V. D.; Rapoport, L. P. (Voronezh State Univ., USSR). pp 29 of Eleventh International Conference on Phenomena in Ionized Gases. Stoll, I. (ed.). Prague; Czechoslovak Academy of Sciences (1973).

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973). See CONF-730906-(P1).

Calculations of atomic properties, which are defined by the second and higher orders of the perturbation theory, are connected with difficulties of calculations of the sum over intermediate states. A semi-empirical method based on the Green function of the valence electron in the quantum defect method is discussed. Analytical calculations of atomic characteristics are described using higher orders of perturbation theory. (MOW)

18178 FRACTIONAL PARENTAGE COEFFICIENTS FOR A SUBSHELL nlj^N OF EQUIVALENT ATOMIC ELECTRONS. Sivtsev, V. I.; Sleptsov, A. A.; Kychkin, I. S.; Rudzikas, Z. B. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 2, 189-205(1974). (In Russian).

The formulas are presented to obtain fractional parentage coefficients with one and two deteched electrons for a subshell nlj^N of equivalent atomic electrons. Their numerical values for $j \leq 7/2$ are given in the tables. A case of an almost filled subshell is considered as well. (auth)

18179 INTERACTION OF A TWO-LEVEL ATOM WITH AN EXTERNAL FIELD. Pargamanik, L. E.; Chebotarev, L. V. (Kharkov State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 8, 1253-1263(Aug 1974). (In Russian).

The two-level atom radiation is studied separately in a permanent field and in a quantized monochromatic field on the basis of resolvent formalism. The power spectrum of the two-level atom in the permanent field is found at each moment, and the dependence of the width and resonant line frequency on the power of the field is determined. For the case of the monochromatic field the radiation is treated as a cascade process. When the intensity of the incident field is large, the power spectrum represents the Stark-triplet with narrowed components due to interference. When one can treat the coupling as powerful enough, the power spectrum consists of a great number of lines and differs essentially from the Stark-spectrum. In both cases the interaction of the atom with the external field is taken into account precisely, but the radiation damping—only to an accuracy degree of $e^2/\hbar c$. (auth)

18180 KINETICS OF TWO-LEVEL ATOM RADIATION. Pargamanik, L. E.; Chebotarev, L. V. (Kharkov State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 8, 1245-1252(Aug 1974). (In Russian).

The non-Markovian quantum kinetic equation for the density matrix of a two level system interacting with a medium in its stationary state is derived under conditions discussed previously. On the basis of this equation the process of light emission by a two-level atom interacting with the radiation field in its excited mixed stationary state is studied. The results concerning the evolution of the atom in a Markovian approximation coincide with the known ones. The changes in the radiation field due to its interaction with the atom are connected with three different processes: stationary scattering of photons, unsteady-state scattering and emission of the atom owing to inconvertible evolution of its state. Two latter processes cease when an equilibrium is established, and only the former continues. The power spectrum of stationary scattering is found including all the non-Markovian effects. (auth)

18181 EXTENSION OF KOOPMANS' THEOREM. I. DERIVATION. Smith, D.W.; Day, O.W. (Department of Chemistry, University of Georgia, Athens, Georgia 30602). J. Chem. Phys. 62: No. 1, 113-114 (1 Jan 1975).

It is shown that the spin orbitals that diagonalize the generalized Hartree—Fock potentials [Int. J. Quantum Chem. Symp., 8, 501 (1974)] for a correlated wavefunction, together with the corresponding orbital energies, give a natural extension of Koopmans' theorem to correlated reference states. (auth)

18182 EXTENSION OF KOOPMANS' THEOREM. II. ACCURATE IONIZATION ENERGIES FROM CORRELATED WAVEFUNCTIONS FOR CLOSED—SHELL ATOMS. Day, O.W.; Smith, D.W. (Department of Chemistry, University of Georgia, Athens, Georgia 30602); Morrison, R.C. J. Chem. Phys. 62: No. 1, 115-119 (1 Jan 1975).

Extended Koopmans' theorem ionization energies are presented for MC—SCF wavefunctions of the $1s^2\ 2s^2$ (^1S) ground-state isoelectronic series, Li^- through O^{4+}, and also for some larger CI wavefunctions of Be and B^+. Correlation in these reference states reduces the error in the Koopmans' ionization energy for the $2s$ electron to approximately 0.01—0.08 eV (1/100—1/20 the SCF Koopmans' error) in all states except the negative ion, for which the MC—SCF extended Koopmans' error of 0.25 eV was of the same magnitude but of opposite sign to the SCF error. Our extended Koopmans' energies for $1s$ ionization were only slightly better than the corresponding SCF values. Koopmans' theorem does not yield a $2p$ ionization energy ($1s^2\ 2s^2 \rightarrow 1s^2\ 2p$), but the extended Koopmans' theorem yields an ionization energy whose error is about one—third the SCF $2s$ error. (auth)

18183 RELATIVISTIC CORRECTIONS IN THE STATISTICAL THEORY OF THE ATOM. Naurzbaev, Zh.; Tarasov, V. F. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 4, 15-20(1974). (In Russian).

The relativistic expressions for the kinetic energy of the electron gas was obtained and its approximate resolution according to the degree of the α^2 square of the constant fine structure was given. A new formula was proposed for the relativistic corrections to the energy of the statistical atom. The relativistic Thomas-Fermi equation was derived in the α^2 approximation and its relation with Schroedinger equations was shown. (tr-auth)

18184 USE OF DOUBLE COSETS IN CONSTRUCTING INTEGRALS OVER SYMMETRY ORBITALS. Davidson, E.R. (Battelle Memorial Institute, Columbus, Ohio 43201). J. Chem. Phys. 62: No. 2, 400-403 (15 Jan 1975).

Double cosets are used to reduce the formulas for integrals over symmetry orbitals to unique integrals over atomic orbitals. (auth)

18185 CALCULATION OF IONIZATION POTENTIALS FROM DENSITY MATRICES AND NATURAL FUNCTIONS, AND THE LONG—RANGE BEHAVIOR OF NATURAL ORBITALS AND ELECTRON DENSITY. Morrell, M.M.; Parr, R.G.; Levy, M. (Department of Chemistry, The Johns Hopkins University, Baltimore, Maryland 21218). J. Chem. Phys. 62: No. 2, 549-554 (15 Jan 1975).

Given an exact eigenfunction ψ for some system with N electrons, a procedure is developed for determining ionization potentials of the system to various states of the corresponding system having $N-p$ electrons. The long—range behavior of the electron density and of the natural spin orbitals is shown to involve a set of eigenvalues which are obtained by this procedure. Following is the procedure. First, determine the pth—order natural functions for ψ, $X_m^{(p)}$, and their occupation numbers $n_m^{(p)}$, by diagonalization of the pth—order density matrix $\Gamma^{(p)}$. Calculate the quantities

$$\lambda_{kl}^{(p)} = n_l^{(p)}\langle X_k^{(p)}(\bar{p})\,|\hat{H}(\bar{p})\,|X_l^{(p)}(\bar{p})\rangle + p(p+1)\int(1/r_{1,p+1})X_k^{(p)*}(\bar{p})X_l^{(p)}(\bar{p}_\xi)$$

$$\times\ \Gamma^{(p+1)}\,(\bar{p}_\xi x_{p+1}\,|\bar{p},\ x_{p+1})\,d\xi_1\ldots d\xi_p\ dx_{p+1}\,dx_1\ldots dx_p,$$

where $\bar{p} \equiv (x_1 x_2 \ldots x_p)$ and $\bar{p}_\xi \equiv (\xi_1\,\xi_2\ldots\xi_p)$. Then diagonalize the Hermitian matrix $\mu^{(p)}{}_{kl} = \lambda^{(p)}{}_{kl}/(n^{(p)}{}_k n^{(p)}{}_l)^{1/2}$. The resultant eigenvalues $\mu_\alpha{}^{(p)}$ are approximations to the negative of the p—electron ionization potentials of the system, with successive $\mu_\alpha{}^{(p)}$(from the highest to the lowest) being lower bounds to the negative successive p—electron ionization potentials (from the lowest to the highest). For an approximate eigenfunction $\tilde{\psi}$, the same procedure is recommended, except that the Hermitian part of the approximate matrix $\tilde{\mu}^{(p)}{}_{kl}$ is diagonalized. For $\tilde{\psi}$, a Hartree—Fock approximation to ψ, the procedure for the case $p = 1$ is the classic method of Koopmans. It is shown that in general all natural spin orbitals $\chi_m(x)$ in a system have long—range expontential fall—off governed by $\mu^{(1)}{}_{\max}$, i.e., $\chi_m(x) \sim \exp[-(-2\mu_{\max}{}^{(1)})^{1/2}r]$, and that the electron density behaves similarly, $\rho(x){\sim}\exp[-2(-2\mu_{\max}{}^{(1)})^{1/2}r]$. The behavior naively expected, namely $\rho(x){\sim}\exp[-2(2I_{\min})^{1/2}r]$, results if $\mu_{\max}(1)$ is equal to $-I_{\min}$. (auth)

18186 FINITE ELEMENT METHOD FOR BOUND STATE CALCULATIONS IN QUANTUM MECHANICS. Askar, A. (Bogazici Universitesi, Mathematics Department, Bebek, Istanbul, Turkey). J. Chem. Phys. 62: No. 2, 732-734 (15 Jan 1975).

The finite element method, which in other fields has replaced finite difference and variational methods, is applied to the radially symmetric case of the hydrogen atom. The method is shown to have computational advantages over the finite difference and Rayleigh—Ritz methods. (AIP)

18187 DECAY OF AN EMITTING DIPOLE BETWEEN TWO PARALLEL MIRRORS. Chance, R.R. (Materials Research Center, Allied Chemical Corporation, Morristown, New Jersey 07960); Prock, A.; Silbey, R. J. Chem. Phys. 62: No. 3, 771-772 (1 Feb 1975).

A classical treatment is presented for the modification of the emission rate of an atom between two parallel mirrors. For the case of two perfectly reflecting mirrors, the results are identical with previous treatments of this problem using a quantum mechanical approach. The purely classical treatment has the advantage of being able to treat nonperfectly reflecting mirrors. (auth)

18188 GROUP THEORETIC PREDICTION OF CONFIGURATION MIXING EFFECTS DUE TO COULOMB REPULSIONS IN ATOMS WITH APPLICATIONS TO DOUBLY—EXCITED SPECTRA. Sinanoğlu, O.; Herrick, D.R. (Sterling Chemistry Laboratory, Yale University, New Haven, Connecticut 06520). J. Chem. Phys. 62: No. 3, 886-892 (1 Feb 1975).

A group theoretical method which predicts Coulomb repulsion mixing coefficients of doubly—excited atomic states is presented. Good agreement with calculated mixings in helium is found. Two new quantum numbers and three rules classify and predict the energy level orderings. The exact mathematical construction of $1/r_{12}$ in the group theoretical configuration—mixed basis is given. It leads naturally to a formulation of the corresponding many—electron problem of configurational mixings. (auth)

18189 A NEW COMPUTATIONAL APPROACH TO SLATER'S SCF—$X\alpha$ EQUATION. Sambe, H.; Felton, R.H. (School of Chemistry, Georgia Institute of Technology, Atlanta, Georgia 30332). J. Chem. Phys. 62: No. 3, 1122-1126 (1 Feb 1975).

A new computational scheme is presented for the performance of LCAO—MO calculations in the SCF—$X\alpha$ model. The scheme is intended to be applicable for large systems and to be more accurate than the scattered—wave SCF—$X\alpha$ method. The $X\alpha$ potential is fitted by least—squares to a linear combination of Gaussians, and the approximated SCF—$X\alpha$ equation is solved by the conventional Rayleigh—Ritz variational method. The muffin—tin approximation is avoided, and matrix elements are calculated analytically in contrast to the discrete variational scheme. Some illustrative results are given for the ionization energies and equilibrium geometries of small molecules. It is found that over—all performance of the method is satisfactory for *both* ionization energies and equilibrium geometries. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstract 16345.

18190 UNSTEADY HYDROMAGNETIC BOUNDARY LAYER FLOW INDUCED BY TORSIONAL OSCILLATIONS OF A DISK. Debnath, L. (East Carolina Univ., Greenville, SC). Plasma Phys.; 16: No. 12, 1121-1128(Dec 1974).

A study is made of the unsteady hydromagnetic boundary layer flow induced by the torsional oscillations of an infinite disk in an electrically conducting rotating fluid in the presence of a uniform magnetic field. Some qualitative and quantitative information is obtained about (i) the structure of the steady and the unsteady flow field, (ii) the development of the Stokes-Ekman-Hartmann boundary layers with their physical implications, (iii) the significant interaction of the electromagnetic and Coriolis forces, (iv) the hydromagnetic Ekman suction velocity and total transient time required for the establishment of the hydromagnetic boundary layers and (v) the generation and propagation of a series of inertial oscillations and the diffused hydromagnetic waves. It is shown that the rapid attainment of the Stokes-Ekman-Hartmann boundary layers and the striking properties of the Ekman suction velocity play a distinctive role on the hydromagnetic spin-up process. Special attention is given to the physical interpretation of the mathematical results obtained. Some limiting cases of interest are discussed. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 18240, 18241, and 18245.

18191 (IFVE-SEF-73-48) CAN THE QUARKS STILL BE FOUND. Landsberg, L. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 24p. (In Russian). INIS.

A critical analysis was carried out of experiments on searches of particles with a charge from the point of view of the possible existence of light quarks which might be retained by some sort of extraordinary spins of the barrier type, and would require large transmitted momenta for knock-out from hadrons. It is shown that many experiments (namely those in which very low upper limits were established for possible cross sections of quark formation) can turn out to be completely insensitive to this mechanism of quark formation with large transverse momenta. Possible methods were analyzed for further searches of quarks in processes with large transmitted momenta ($Q^2 \sim$ 20 to 100 $(GeV/c)^2$). (tr-SJR)

Electromagnetic

Refer also to abstract 17759.

18192 (AD-780089) SOURCES OF COMPTON CURRENTS FROM NUCLEAR BURSTS IN THE ATMOSPHERE. Final Report. Cohen, M. O. (Mathematical Applications Group, Inc., Elmsford, N. Y. (USA)). Apr 1974. 34p. (MR-7038; HDL-TR-252-1). NTIS $3.25.

A series of Monte Carlo calculations were performed to determine the energy deposition and Compton electron sources in air arising from atmospheric nuclear bursts. The time-dependent results were obtained in 92 radial and altitude scoring bins surrounding a burst 200 meters above the ground. Ranges of 0 to 333 gm/cm squared were considered in all directions from the source. Both a representative gamma ray and a thermonuclear neutron source were investigated. (auth)

18193 (JINR-E2-8240) HOW LARGE IS THE PION CHARGE RADIUS FROM DUBNA-UCLA FORM FACTOR MEASUREMENTS? Dubnicka, S.; Dumbrais, O. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

Recent experimental values of the pion form factor in the space-like region were reanalyzed in a model-independent way by using analyticity arguments. The most unbiased value of the pion charge radius was found to be $\langle r^2\rangle^{1/2} = 0.71 \pm 0.05$ fm. (auth)

18194 (LAL-1270) COHERENT PHOTOPRODUCTION OF π^0 MESON ON DEUTERON. Petroff, P. (Paris-11 Univ., 91 - Orsay (France)). Nov 1973. 151p. (In French). Dep. NTIS (US Sales Only) $10.75.

Thesis.

The differential cross sections of the reaction $\gamma d \rightarrow \pi^0 d$ were measured at constant momentum transfer, using a counter technique, in large kinematical region, ranging from 240 to 1000 MeV/c momentum transfer and from 220 to 1400 MeV laboratory photon energy. The bremsstrahlung photon beam is produced by allowing the Linac electron beam to pass through a 0.05 radiation length copper foil. The electron beam is then deflected by a sweeping magnet. The recoil deuterons are momentum analyzed by a 180° double focusing spectrometer and detected by scintillator counters. The proton flux is several times larger than the deuteron flux. A discrimination between deuterons and protons is obtained by range and energy loss requirements. A multidimensional off-line analysis of the pulse height spectrum in the counter is performed, resulting in less than 4% contamination of the deuteron background signal. The impulse approximation model does not fit the data, particularly, at high momentum transfer, when the rescattering process seems to be important. An estimation of the rescattering terms, including the intermediate pion charge exchange, was performed. This contributing improves the shape of the theoretical curve obtained with the impulse approximation. In the range of considered momentum transfer, the rescattering terms are indeed necessary to obtain agreement with experimental data. (auth)

18195 SOME BACKGROUND PROBLEMS IN PHOTON-PHOTON COLLISIONS IN ELECTRON-POSITRON STORAGE RINGS. Parisi, J. (College de France, Paris). J. Phys. (Paris), Colloq.; No. 2, 51-59(1974).

From international colloquium on photon-photon collisions in electron-positron storage rings; Paris, France (3 Sep 1973).

For colliding beam reactions of the type ee → eeX ($X = \mu^-\mu^+$; $\pi^-\pi^+$; K^-K^+; any hadrons), one compares the contribution of the background (heavy-photon bremsstrahlung type diagram) with that of the main effect (photon-photon collision type diagram) in the case where one of the electrons comes out at small angle and the other one at large angle ($\theta > 2$ deg). At a beam energy of 3 GeV, it appears, for some particular values of ranges of the total invariant mass produced, that the noise/signal ratio may exceed 100% already at moderately large values of theta. A procedure is suggested in order to reduce this ratio. It is shown that the background problem is much less critical at lower beam energies. (auth)

18196 EXPERIMENTAL EVIDENCE OF VIRTUAL COMPTON SCATTERING. Outlook of Studying $\gamma\gamma$ PROCESSES WITH DOI. Courau, A. (Ecole Normale Superieure, Orsay, France). J. Phys. (Paris), Colloq.; No. 2, 45-49(1974).

From international colloquium on photon-photon collisions in electron-positron storage rings; Paris, France (3 Sep 1973).

An experimental evidence, obtained at Orsay of a reaction somewhat related to the $\gamma\gamma$ processes, namely the virtual Compton scattering is reported. Then the outlook of studying $\gamma\gamma$ experiments with the new machine now in construction is breifly discussed. (auth)

18197 MONTE CARLO INVESTIGATION OF THE SPATIAL DEVELOPMENT OF COSMIC RAY SHOWERS IN THE ENERGY REGION OF 1 TO 1000 TeV. Sawaf, Z. Aachen; Technische Hochschule (1972). 166p. (In German).

Thesis.

The calculations for electromagnetic cascades caused by photons with energies of 1 to 100 TeV are worked out, and bremsstrahlung, ionization losses, multiple scattering, pair formation, and the Compton effect are taken into account. The results are compared with the analytic results: the descrepancies can be attributed to simplifications introduced into the latter. The Monte Carlo method yields information on the electron energy spectrum and the photon energy spectrum and lateral distribution not available elsewhere. The same method is applied to extended air showers with primary proton energies of 10 to 1000 TeV and gives satisfactory agreement with experimental data. Lead shielding of showers is studied, and an absorption factor is derived. The search for quarks in air showers is discussed, and appropriate models are described and evaluated. (IAA)

18198 PHOTON-PHOTON COLLISION EXPERIMENTS AT SPEAR. Feldman, G. J. (Stanford Linear Accelerator Center, CA). J. Phys. (Paris), Colloq.; No. 2, 29-33(1974).

From international colloquium on photon-photon collisions in electron-positron storage rings; Paris, France (3 Sep 1973).

The SLAC electron-positron colliding beam facility and its associated magnetic detector facility are described. General experimental problems in performing photon-photon collision experiments at SPEAR and the proposed experiment of Masek et al., are discussed. (auth)

18199 ELECTRON-POSITRON INTERACTIONS AT 5 GeV IN THE CENTER-OF-MASS: BHABHA SCATTERING AND MULTIHADRON PRODUCTION. Newman, H. B. (Massachusetts Inst. of Tech., Cambridge). J. Phys. (Paris), Colloq.; No. 2, 21-28 (1974).

From international colloquium on photon-photon collisions in electron-positron storage rings; Paris, France (3 Sep 1973).

The cross sections for electron-positron elastic scattering and electron-positron annihilation into three or more hadrons were measured at 5 GeV center-of-mass energy (228 ± 15) $e^+e^- \rightarrow e^+e^-$ events were observed with scattering angles between 50 deg and 130 deg, while the time-integrated luminosity was measured as $1.22 \pm 0.06 \times 10^{34}$ cm^{-2}. A calculation of the theoretical (QED) cross section yields a ratio of the experimental to the calculated cross section for Bhabha scattering of 1.03 ± 0.08. 108 events of the type $e^+e^- \rightarrow$ multihadrons were also observed between scattering angles of 45 deg and 135 deg, during a period of the same experimental run corresponding to a time-integrated luminosity of $1.14 \pm 0.06 \times 10^{34}$ cm^{-2}. A model-independent lower limit on the hadron production cross section of 9.5 ± 1.1 nb is therefore obtained. Detection efficiency calculations based on invariant phase production of pions lead to an estimated total cross section of

22 ± 5 nb, which is 6.3 ± 1.4 times the $e^+e^- \rightarrow \mu^+\mu^-$ theoretical cross section. (auth)

18200 RESEARCHES IN FRASCATI ON THE REACTIONS $e^+e^- \rightarrow e^+e^- + X$. The Results of the $\gamma\gamma$ Group. Salvini, G. (Univ., Rome). J. Phys. (Paris), Colloq.; No. 2, 1-8(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

A general survey is given of the possibilities for performing photon–photon collisions with the Frascati storage ring ADONE, and the corresponding set-ups used. The experiments already performed by the "$\gamma\gamma$ group" are considered in particular. At beam energy 1400 to 1500 MeV, 46 events of the type $e^-e^+ \rightarrow e^-e^+e^-e^+$ and a few events of the type $e^-e^+ \rightarrow e^-e^+\mu^-\mu^+$ were analyzed. More than half of the electron-pair production events (with tagging of only one forward-scattered primary electron) did not belong to the photon–photon collision mechanism (two quasi real photons), but to the mechanism suggested by Cabibbo and G. Parisi (one quasi real and one highly virtual photon). (auth)

18201 EXPERIMENTS ON ELECTROPRODUCTION OF e^+e^- PAIRS WITH COLLIDING BEAMS AT NOVOSIBIRSK. Sidorov, V. A. (Inst. of Nuclear Physics, Novosibirsk, USSR). J. Phys. (Paris), Colloq.; No. 2, 15-19(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

The data of two experiments performed in 1969 and 1970 with VEPP-2, concerning the reaction $e^-e^+ \rightarrow e^-e^+e^-e^+$, and the corresponding analysis performed by Baier and Fadin are presented. An outlook is given on the future, in particular on the storage ring VEPP-4 (7 GeV per beam) now under construction at Novosibirsk, and on the magnetic detector MD-1 to be used with that machine. (auth)

18202 INVESTIGATION OF PHOTON–PHOTON INTERACTIONS BY e^+e^- BEAMS COLLIDING WITH 2.7 GeV TOTAL ENERGY. Ceradini, F. (Rome Univ.); Conversi, M.; D'Angelo, S.; Ferrer, M. L.; Paoluzi, L.; Santonico, R.; Barbiellini, G.; Orito, S.; Tsuru, T.; Visentin, R. J. Phys. (Paris), Colloq.; No. 2, 9-13 (1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

The photon–photon interaction was investigated by e^+ and e^- collisions at about 2.7 GeV total energy. Evidence based on 34 well identified events was obtained for process $e^+e^- \rightarrow e^+e^-\mu^+\mu^-$, hitherto unobserved. Such a process is found to occur in agreement with theoretical predictions based on the equivalent photon approximation. Results on 76 events from process $e^+e^- \rightarrow e^+e^-e^+e^-$ are also reported. (auth)

18203 EXPERIMENTAL SEARCH FOR A LOW–MASS SCALAR BOSON. Kohler, D.; Watson, B.A.; Becker, J.A. (Lockheed Palo Alto Research Laboratory, Palo Alto, California 94304). Phys. Rev. Lett. 33: No. 27, 1628-1631 (30 Dec 1974).

Two experiments are reported in which a search was made for the scalar boson predicted to be produced in the $^{16}O(6.05\ MeV)$ to ground state and $^4He(20.2\ MeV)$ to ground state 0^+ to 0^+ transitions with subsequent in–flight decay into electron–positron pairs. Taken together, our results show that the light scalar boson proposed by Sundaresan and Watson to account for certain muonic x–ray energy discrepancies cannot have a mass in the range $1.030 \leq m \leq 18.2$ MeV. (auth)

Weak

Refer also to abstract 18292.

18204 (COO-3071-108) EXPERIMENTAL MEASUREMENT OF THE FORM FACTORS OF THE DECAY $K_L^0 \rightarrow \pi^\pm e^\mp \nu$. Blumenthal, R.; Frankel, S.; Nagy, J.; Resvanis, L.; Van Dyck, O.; Werbeck, R.; Winston, R.; Highland, V. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Sep 1974. 17p. Dep. NTIS $4.00.

There were 25,000 K_{e3} decays analyzed reconstructed to the center of mass by measurement of the K_L^0 momentum from time of flight and measurement of the π and e momenta with a spark chamber-magnet spectrometer. Electrons were detected with a gas Cherenkov counter. Using the linear parametrization of the vector form factor $f_+(q^2) = 1 + \lambda_+(q^2/m_\pi^2)$, one finds $\lambda_+ = 0.0270 \pm 0.0028$. A quadratic fit to $f_+(q^2) = 1 + \lambda'_+(q^2/m_\pi^2) + \lambda''_+(q^2/m_\pi^2)^2$ gave $\lambda'_+ = 0.0319 \pm 0.0114$, $\lambda''_+ = 0.0009 \pm 0.0020$. The separate values for the conjugate decays $K_L^0 \rightarrow \pi^+e^-\bar{\nu}$ and $K_L^0 \rightarrow \pi^-e^+\nu$ are respectively 0.0250 ± 0.0041 and 0.0297 ± 0.0043. Upper limits for the scalar (f_s) and tensor (f_t) form factors at the 68% confidence level are $f_s/f_+ < 0.04$ and $f_t/f_+ < 0.23$ corresponding to intensity ratios $I_s/I_v < 0.3\%$ and $I_t/I_v < 0.4\%$. (auth)

18205 HAS A NEW TYPE OF ELEMENTARY INTERACTION BEEN DETECTED AT CERN? Musset, P.; Rousset, A. (European Organization for Nuclear Research, Geneva). Ind. At. Spatiales; 18: No. 3, 11-16(May 1974). (In French).

Experimental findings on neutrino interactions were recently derived in the GARGAMELLE bubble chamber at CERN. They provide definite data in favor of the existence of a new phenomenon, that of neutrino interactions without producing electrically-charged muon, or electron particles. Interpreted as a neutral current, this new phenomenon is endowed with an intensity that was predicted by some theories. Two types of interactions, heretofore viewed as distinct, can now be interfaced: electromagnetic interactions and Fermi's weak interactions. They may now be integrated into a unified scheme which, at the same time, can counteract the well-known drawbacks of previous theories. Experimental details and decisive implications are analyzed. (auth)

Strong (Baryon-induced)

Refer also to abstract 18425.

18206 (ANL/HEP-7440) SYMPOSIUM ON HIGH-ENERGY PHYSICS WITH POLARIZED BEAMS, ARGONNE, ILLINOIS, FEBRUARY 8, 1974. Thomas, G.; Yokosawa, A. (eds.). (Argonne National Lab., Ill. (USA)). Feb 1974. 240p. (CONF-740226-). Dep. NTIS $15.00.

Separate abstracts were prepared for ten of the papers in this report. The remaining three have already been cited in NSA with the following abstract numbers: 30: 13342, 30: 22240, and 30: 25279. (RWR)

18207 (ANL/HEP-7440, pp XI.1-XI.11) POLARIZATION EFFECTS IN INCLUSIVE Λ^0 PRODUCTION: PROSPECTS FOR POLARIZED HYPERON BEAMS. Swallow, E. C. (Enrico Fermi Inst., Chicago). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

Interesting new experiments which could be performed with a copious source of polarized hyperons, particularly lambdas. The observable spin effects which can occur when self-analyzing hyperons are produced with the Zero Gradient Synchrotron polarized proton beam are considered. Preliminary results from the Argonne–Chicago–Ohio State experiment on $p\uparrow + p \rightarrow \Lambda^0 + X$ at 6 GeV/c are presented. (4 figures) (auth)

18208 (ANL/HEP-7440, pp XIII.1-XIII.8) EXPERIMENTAL PROGRAM FOR p–p SCATTERING-AMPLITUDE MEASUREMENTS. Yokosawa, A. (Argonne National Lab., IL). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

"First-stage" scattering-amplitude measurements for the pp system from 1 to 12 GeV/c are considered; these require a relatively simple experimental setup, and, since a small |t| region is involved, permit a high-precision measurement. The use of polarized beams and targets is discussed. Possible experiments for measuring the numerous quantities necessary are detailed. (2 figures, 2 tables) (RWR)

18209 (ANL/HEP-7440, pp XV.1-XV.19) INELASTIC POLARIZED PROTON INTERACTIONS AT 6 GeV/c. Wicklund, A. B. (Argonne National Lab., IL). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

A polarized proton beam is an ideal tool for studying inelastic proton–nucleon interactions such as $\vec{p}p \rightarrow (p\pi^+)n$, $\vec{p}p \rightarrow (p\pi^-)\Delta^{++}$, $\vec{p}p \rightarrow (p\pi^+\pi^-)p$, and $\vec{p}n \rightarrow (p\pi^-)p$. Preliminary data taken with the Effective Mass Spectrometer (EMS) are reviewed to impart an idea as to the kind of physics that can be studied. The EMS looks at the decay products of fast forward N*'s that are associated with the polarized beam proton. The $\vec{p}p \rightarrow (p\pi^+)n$ reaction is emphasized. Mass spectra, differential cross sections, asymmetries, polarizations, and density matrix elements are shown. (9 figures) (RWR)

18210 (BNL-19364) TOTAL CROSS SECTIONS OF $\pi^\pm$, $K^\pm$, p AND $\bar{p}$p ON PROTONS AND DEUTERONS AT VERY HIGH ENERGIES. Kycia, T. F. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 37p. (CONF-740739-2). Dep. NTIS $5.00.

From SLAC summer institute on particle physics; Stanford, California, USA (29 Jul 1974).

A total cross section measurement is reported in which total cross sections of $\pi^\pm$, $K^\pm$, protons, and antiprotons on protons and deuterons at four momenta from 50 to 200 GeV/c were measured. A good geometry transmission technique was used. (JFP)

18211 (COO-3065-91) RECENT RESULTS FROM BUBBLE CHAMBER EXPERIMENTS AT FERMILAB. Ferbel, T. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 31 Aug 1974. Contract AT(11-1)-3065. 62p. (CONF-740739-1; UR-500). Dep. NTIS $6.00.

From SLAC summer institute on particle physics; Stanford, California, USA (29 Jul 1974).

Recent results on various properties of pp interactions are reviewed. (JFP)

18212 (CRN/HE-74-10) ELECTRON PRODUCTION AT HIGH TRANSVERSE MOMENTUM IN THE PROTON–PROTON HIGH ENERGY INTERACTION IN CERN-ISR MASS CENTER. Gresser, J. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires). 1974. 164p. (In French). Dep. NTIS (US Sales Only) $11.25.

Thesis. Submitted to Strasbourg Univ., France.

The interest of the experiments at the ISR is that the available energy in the GM system is much greater than with a beam from a normal accelerator on a target at rest (2 protons each having 28 GeV energy in a head-on collision give a CM energy corresponding to a classical beam of 1600 GeV). This energy would be enough to create heavy particles such as intermediate bosons ($W^{\pm}$ or W^0). These particles can decay into two particles of which at least one is an electron. In that case, the electron momentum is high and of the order of half the mass of the particle itself. The electrons come mainly from the π^0 decays; but their transverse momentum distributions fall off rapidly, as the hadrons. Then, if one observes electrons with very high momenta, relative to the hadronic sources, one can imagine the production of these heavy particles. The electrons were detected with a set of wire spark chambers. The deflection by a magnet gives the momentum. A threshold Cherenkov counter discriminates the electrons against heavier particles. The rejection power is improved with sandwich counters and optical spark chambers detecting the electromagnetic shower 800,000 events were recorded; only 12 fulfill all conditions imposed on electron recognition. They fit with the calculated background. No electron with a momentum larger than 3 GeV/c was found. An upper limit on the production of a single electron can therefore be given: 1.2×10^{-33} cm^2/sr at a 95% confidence level. This limit is discussed in terms of virtual gamma-ray and W-meson production. (auth)

18213 (FERMILAB-Conf-74/98) RECENT RESULTS ON INCLUSIVE REACTIONS. Dao, F. T. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Sep 1974. 38p. (CONF-740933-2). Dep. NTIS $5.00.

From meeting of the Division of Particles and Fields of the American Physical Society; Williamsburg, Virginia, USA (5 Sep 1974).

Data concerning charged particle multiplicities, correlations between particles and single-particle inclusive distributions produced in high energy collisions are reviewed. (auth)

18214 (LAL-1271) $K^-p \to \Lambda^0$ + NEUTRALS REACTIONS AT C. M. ENERGIES COMPRISED BETWEEN 1580 AND 1750 MeV. Colas, J. (Paris-11 Univ., 91 - Orsay (France)). Dec 1973. 187p. (In French). Dep. NTIS (US Sales Only) $12.50.

Thesis.

The reactions $K^-p \to \Lambda^0$ + neutrals ($K^-p \to \Lambda^0\pi^0, \Sigma^0\pi^0, \Lambda^0\pi^0\pi^0 \ldots$) were investigated as a direct mean of detecting the Y^* with zero isospin, coupled to these channels. Charged final states in principle contain the same information but, as they are mixtures of states with zero and one isospins, the separation of $Y^*(0)$ resonances would necessitate a phase shift analysis. The various channels were studied in the K^- momentum range comprised between 520 and 820 MeV/c. Total cross sections are presented for $K^-p \to \Lambda\eta^0, \Lambda\pi^0, \Sigma^0\pi^0, \Lambda^0\pi^0\pi^0$, and $\Sigma^0\pi^0\pi^0$ channels and differential cross sections for $\Lambda^0\pi^0$ and $\Sigma^0\pi^0$ channels. The data were obtained from an experiment in heavy liquid bubble chamber with an average efficiency of 70% in gamma detection. Only events with all decay gamma detected were used for the analysis and the hydrogen interactions were extracted by kinematic fitting. The various analysis effected agree with the existence of at least three resonances between 1600 and 1700 MeV: $\Lambda(1670)\ {}^1\!/_2^-\ S_{01}$, $\Lambda(1690)\ {}^3\!/_2^-\ D_{03}$, and $\Sigma(1670)\ {}^3\!/_2^-\ D_{13}$; a $\Sigma(1620)\ {}^1\!/_2^-\ S_{11}$ is suggested. The total cross section obtained for the reaction $K^-p \to \Sigma^0\pi^0$ is 30% lower than some values previously published by the CHS collaboration for the 1670 MeV region. This result must affect the branching ratio of $\Lambda(1670)$ into the $\Sigma^0\pi^0$ final state. (auth)

18215 (LBL-3608) EXPERIMENTAL STUDY OF THE LAMBDA-PROTON INTERACTION. Hauptman, J. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 1 Aug 1974. Contract W-7405-eng-48. 244p. Dep. NTIS $15.25.

Thesis.

The results of a study of Λp interactions in the intermediate momentum range from 0.5 to 10.0 GeV/c Λ laboratory momentum are presented. A total Λ pathlength of 2.1×10^6 cm was obtained in the 82-inch liquid hydrogen bubble chamber, corresponding to a flux of roughly 60 events/mb. Cross sections for the elastic, inelastic, and resonant production reactions are given, in addition to a measurement of the Λp total section. The channels $\Lambda p \to \Lambda p$, $\Lambda p \to \Sigma^+ p\pi^-$, $\Lambda p \to \Sigma^- p\pi^+$, $\Lambda p \to \Lambda p\pi^+\pi^-$, and $\Lambda p \to \Sigma^0 p$ were studied. One does not observe resonant or cusp-like behavior in the elastic reaction near the $\Lambda p \to \Sigma^0 p$ threshold. The pion production reactions $\Lambda p \to \Sigma p\pi$ and $\Lambda p \to \Lambda p\pi\pi$ are mediated in large part by single pion exchange, and display rich resonant production of the ${}^3\!/_2^+$ baryon decuplet. Although the data are somewhat limited in statistical precision, the Λp interactions studied are approximately consistent with SU(3) symmetry. (auth)

18216 OBSERVATION OF CHARGE–INDEPENDENCE–VIOLATING EFFECTS IN $\bar{p}d$ ANNIHILATIONS AT REST. Kalogeropoulos, T.E. (Department of Physics, Syracuse University, Syracuse, New York 13210); Fillipas, T.A.; Grammatikakis, G.; Papadopoulou, T.; Simopoulou, E.; Vayaki, A.; Gray, L.; Roy, J.; Tzanakos, G. Phys. Rev. Lett. 33: No. 27, 1631-1635 (30 Dec 1974).

For $\bar{p}d$ annihilations at rest, charge independence and energy conservation imply that the average energy going to charged pions is $\langle E_{\pm} \rangle = 1241 \pm 2$ MeV per annihilation. Experimentally this number is found to be 1169 ± 10 MeV after corrections for events with invisible $K^0\bar{K}^0$. This discrepancy of 72 ± 10 MeV cannot be accounted for by the known η and ω production, which is estimated to contribute $\sim 14 \pm 3$ MeV. (auth)

18217 TEST OF PARITY CONSERVATION IN p–p SCATTERING. Potter, J.M.; Bowman, J.D.; Hwang, C.F.; McKibben, J.L.; Mischke, R.E.; Nagle, D.E. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544); Debrunner, P.G.; Frauenfelder, H.; Sorensen, L.B. Phys. Rev. Lett. 33: No. 21, 1307-1310 (18 Nov 1974).

We report a result of $(1 \pm 4) \times 10^{-7}$ for the parity–nonconserving component in the p–p nuclear cross section at 15 MeV. Our experiment uses rapid spin reversal of a longitudinally polarized proton beam and an unpolarized H_2 target. Sources of systematic error are discussed and found to be $< 10^{-7}$. (auth)

18218 OBSERVATION OF EXCESSIVE AND DIRECT γ PRODUCTION IN $\bar{p}d$ ANNIHILATIONS AT REST. Kalogeropoulos, T.E. (Department of Physics, Syracuse University, Syracuse, New York 13210); Vayaki, A.; Grammatikakis, G.; Tsilimigras, T.; Simopoulou, E. Phys. Rev. Lett. 33: No. 27, 1635-1637 (30 Dec 1974).

The charge–independence–violating effects observed in the previous paper are caused by the production of 0.73 ± 0.08 γ per annihilation above what is expected, 3.04 ± 0.02, from charge independence. The γ–energy spectrum extends over the γ spectrum generated from π^0. The spectra associated with specific topologies show peaks which are indicative of electromagnetic transitions between $\bar{p}N$ bound states or states of the cosmion (C). (auth)

18219 NONOBSERVATION OF HEAVIER J PARTICLES FROM p–N REACTIONS. Aubert, J.J.; Becker, U.J.; Biggs, P.J.; Burger, J.; Chen, M.; Everhart, G.; Goldhagen, P.; Leong, J.; McCorriston, T.; Rhoades, T.G.; Rohde, M.; Ting, S.C.C.; Wu, S.L. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Glenn, J.W. III; Lee, Y.Y. Phys. Rev. Lett. 33: No. 27, 1624-1625 (30 Dec 1974).

After the discovery of the J particle at 3.1–GeV mass we have made an extensive search for heavier J particles in the mass region 3.2 to 4.0 GeV. To a level of 1% of J(3.1 GeV) yield, and with 90% confidence, no heavier J particles were found. (auth)

18220 OBSERVATION OF LARGE TRANSVERSE MOMENTUM PIONS AND SEARCH FOR ELECTRONS AT THE ISR. Pope, B. G. (CERN, Geneva). J. Phys. (Paris), Colloq.; No. 1, 409-413(1973).

From 2nd international conference on elementary particles; Aix-en-Provence, France (6 Sep 1973).

Two experiments searching for neutral and charged pions of large transverse momentum produced at the CERN-ISR are described. (auth)

18221 DOES NUCLEAR EXCITATION ASSOCIATED WITH MULTIPLE PRODUCTION IN HIGH ENERGY PROTON–NUCLEUS COLLISIONS DEPEND ON PRIMARY ENERGY. Friedlaender, E. M. (Inst. of Atomic Physics, Bucharest); Nitu, R.; Vogel, A. Rev. Roum. Phys.; 19: No. 8, 863-869(1974).

Investigation of ~14,000 heavy prongs from nuclear breakup following meson producing proton–nucleus collisions at 10 and 200 GeV in nuclear emulsion shows that in this energy range the mean energy transfer to the nucleus does not change significantly. (auth)

18222 RISING TOTAL CROSS SECTIONS AND HADRON STRUCTURE. Kuroda, M.; Miyazawa, H.; Yamaguchi, Y. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 2, 541-545(Feb 1974).

The increasing pp total cross section recently measured at ISR is discussed in the framework of a composite model of hadrons. Assuming that hadrons are made of a few number of constituent quarks, and allowing a reasonable s-dependence in the quark-quark scattering amplitude as suggested by the Regge polology, the growth of hadron-hadron total cross sections is evaluated. (auth)

18223 INCLUSIVE REACTIONS. Boeggild, H. (Univ. of Copenhagen); Ferbel, T. Annu. Rev. Nucl. Sci.; 24: 451-513 (1974).

This review of high-energy phenomena begins by considering nomenclature; inclusive measurements and kinematic variables are discussed. Limiting behavior and inclusive production spectra are examined by describing expectations at asymptotic energies, Mueller's theorem and its applications, the region of proton fragmentation, the central region, two-pion production, and dependence on p_T. Then the systematics of charged and neutral particle production is treated, including semi-inclusive scaling, moments of the multiplicity distribution, and particle composition. Next, the diffractive-production phenomenon is taken up; kinematic regions of interest and triple-Regge analysis and comparison with data are covered. Finally, correlations in production are addressed; charge and prong correlations, longitudinal rapidity correlations, and transverse momentum correlations are studied. (52 figures, 56 references) (RWR)

Strong (Meson-induced)

18224 (LA-tr-74-33) MEASUREMENT OF POLARIZATION OF RECOIL PROTONS IN (π^-p) ELASTIC SCATTERING AT 485 MeV. Bekrenev, V. S.; Gordeev, V. A.; Kashchuk, A. P. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). Sep 1973. Translated by Helen J. Dahlby from Russian. 43p. Dep. NTIS $5.25.

Apparatus has been developed to measure polarization of recoil protons in (πp) elastic scattering by the secondary scattering of these protons on a carbon target. The experimental set-up consists of 24 wire spark chambers with magnetostrictive read-out for the determination of the spatial position of trajectories of scattered particles and a time-of-flight analysis system. Data obtained permit performing complete kinematical reconstruction of each event and determining a value of polarization based on an analysis of the secondary scattering parameters. The results of the first measurements at 485 MeV are presented. (auth)

18225 (LBL-3095) REACTION $\pi^-p \rightarrow \eta n$ BETWEEN 20 GeV/c AND 100 GeV/c. Dahl, O. L.; Johnson, R. A.; Kenney, R. W.; Pripstein, M.; Barnes, A. V.; Mellema, D. J.; Tollestrup, A. V.; Walker, R. L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1974. Contract W-7405-eng-48. 22p. (CONF-740713-36). Dep. NTIS $4.25.

From 17th international conference on high-energy physics; London, UK (1 Jul 1974).

Preliminary $d\sigma/dt$ distributions are presented for the reaction $\pi^-p \rightarrow \eta n$ ($0 < -t < 1.2$ (GeV/c)^2). Incident pion momenta were 20.7, 40.6, 66 and 101 GeV/c, obtained at the NAL Meson Laboratory. The effective Regge A_2 trajectory for these data is discussed. Evidence from neutral final states is presented for the production of ω^0 and η' mesons as well as for an enhancement in the f^0, A_2 mass range. (auth)

18226 (ORO-2504-225) LOW ENERGY K^+–d INTERACTIONS. Trevvett, D. E. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Sep 1974. 164p. Dep. NTIS $11.25. Thesis.

A bubble chamber experiment was performed in order to study K^+–d interactions below 600 MeV/c; the reaction $K^+ + d \rightarrow K^+ + d$ (elastic) and $K^+ + d \rightarrow K^+ + p + n$ (breakup) were examined at incident K^+ momenta of 342 and 470 MeV/c. From the 16,000 photographs examined about 2000 on-beam two-prong K-scatters were found at each momentum. For most of the elastic scatter candidates, the breakup hypothesis could not be specifically excluded; thus it was necessary to consider the possibility of breakup contamination in the elastic sample. A 2% confidence level cut was imposed on the elastic sample to improve the separation of events into these two categories; p–n angle and relative momentum distributions were studied to estimate the remaining contamination. Differential cross sections were obtained for both reactions; azimuthal symmetry was used to correct them for certain losses. A phase shift analysis was performed on the elastic distribution in an attempt to extract the I = 0 K^+ – N phase shifts; a single scattering impulse approximation with a moving nucleon target was used to connect these to the observed scattering. S and P waves were sufficient to give excellent fits to the data at both momenta, as long as an anomalous "bump" in the backward region of the K scattering angle distribution (assumed to be a statistical fluctuation) was omitted from the analysis. The values obtained for these phase shifts were, however, much larger than those found in the analyses of previous experiments. The differences are examined and judged to be probably reconcilable, even within the context of the single scattering model. (auth)

18227 EVIDENCE FOR A NON–HULTHÉN IMPULSE–MODEL COMPONENT IN $K+d \rightarrow K^{*0}(890)pp$ at 2.0 GeV/c. Poster, R.; Schlein, P.E.; Slater, W.E. (University of California, Los Angeles, California 90024); Barish, B.; Dzierba, A.; Firestone, A.; Gomez, R.; Dao, F.T.; Malamud, E. Phys. Rev. Lett. 33: No. 27, 1625-1628 (30 Dec 1974).

In a study of $K^+d \rightarrow K^{*0}(890)pp$ at 2.0 GeV/c, evidence is found for the occurrence of the single–pion virtual state $d \rightarrow \pi^-(pp)$ associated with the high–momentum tail of the deuteron. (auth)

Particle Interactions and Properties (Theoretical)

18228 (ANL/HEP-7440, pp XII.1-XII.8) SOME RECENT DEVELOPMENTS IN POLARIZATION PHYSICS. Moravcsik, M. J. (Univ. of Oregon, Eugene). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams. The role of polarization in particle physics and a few recent developments relating to such polarization are considered. Polarization is important in testing specific models and determining the S matrix. The very-short-range behavior of nuclear forces is also briefly addressed. (RWR)

General

Refer also to abstract 18701.

18229 (ANL/HEP-7458) DIRECT EVIDENCE FOR INDEPENDENT EMISSION OF CLUSTERS. Quigg, C.; Pirila, P.; Thomas, G. H. (Argonne National Lab., Ill. (USA)). Oct 1974. 8p. (CONF-750103-1). Dep. NTIS $4.00.

From meeting of the American Physical Society; Anaheim, California, USA (29 Jan 1975).

In the distribution of rapidity gaps between charged particles produced at Fermi Lab energies, direct evidence is found for the independent production of clusters with density approximately one per unit of rapidity. This model-independent cluster density measurement and the observed charged-particle density imply that the mean number of charged particles per cluster is about two. Implications of these numbers and techniques for refining them are discussed. (auth)

18230 (BNL-19288) INVARIANCE PRINCIPLES AND SPIN. Trueman, T. L. (Brookhaven National Lab., Upton, N. Y. (USA)). Oct 1974. 38p. (CONF-740673-6). Dep. NTIS $5.00.

From workshop on polarized targets; Upton, L. I., New York, USA (3 Jun 1974).

An elementary description is given of scattering from polarized targets. Total cross sections, polarization in various reference frames, R = baryon of spin, J, R = meson of spin J, and $\pi + N \rightarrow \Lambda + X$ are treated. (JFP)

18231 (BNL-19382) TACIT ASSUMPTIONS IN FUNDAMENTAL PARTICLE PHYSICS. Goldhaber, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 13p. (CONF-740485-1). Dep. NTIS $4.00.

From meeting of the American Philosophical Society; Philadelphia, Pennsylvania, USA (18 Apr 1974).

The thinking regarding the many tacit assumptions in science is described. It is pointed out that they are not often called into question unless some difficulty is encountered. Some examples are given and discussed of assumptions which are often taught as if they were self-evident. (JFP)

18232 (CNRS-CPT-P–73-576) NULL-PLANE COMMUTATORS IN THE SPONTANEOUSLY BROKEN GAUGE THEORY OF

VECTOR DOMINANCE. Banyai, L. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Sep 1973. 14p. Dep NTIS (US Sales Only) $4.00.

Null-plane commutators of the currents in the spontaneously broken gauge theory of vector dominance are discussed, in comparison with those of the traditional field algebra model, using Dirac's canonical formalism. (auth)

18233 (FERMILAB-Conf-74/77) RECENT PROGRESS IN THE REGGEON CALCULUS. White, A. R. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Aug 1974. 18p. (CONF-740852-1). Dep. NTIS $4.00.

From SLAC topical conference on strong interactions; Stanford, California, USA (8 Aug 1974).

The theoretical and experimental properties of the strong coupling solution of the Reggeon calculus are reviewed. The analogy of rising total cross sections with a critical phenomenon is emphasized as well as the consistency of the solution with both t and s-channel unitarity. The status of other solutions is also briefly discussed. (auth)

18234 (ITF–73-16–R) DISTRIBUTION IN FIREBALL VELOCITIES IN THE DUAL RESONANCE MODEL. Demchenko, G. P.; Kukhtin, V. V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1973. 10p. (In Russian). INIS.

On the basis of a dual resonance model a calculation is carried out on the fireball velocity distribution $F_\nu(\lambda)$. A comparison of the fireball velocity distribution $F_\nu(\lambda)$ is carried out with the experimental distribution $F(\lambda)$ and the distribution found in the multiregge model. (tr–SJR)

18235 (JINR-E2-8223) RELATIVISTIC FORM FACTORS OF MANY-BODY SYSTEMS. Garsevanishvili, V. R.; Matveev, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

The "light-front" form of the quasipotential approach in quantum field theory is applied for constructing the relativistic form factors of many-body composite systems. (auth)

18236 (JINR-E2-8243) SOME REMARKS ON KNO SCALING. Tataru-Mihai, P. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

A model independent qualitative discussion of Koba–Nielsen–Olesen (KNO) scaling is performed. Conditions for the onset of KNO scaling (i.e., the independence of energy of the quantities $C_q = \langle n^q \rangle / \langle n \rangle q$) as well as indications about the behavior of the multiplicity distribution consistent with KNO scaling are obtained. Finally, the connections between KNO scaling and a scaling relation proposed by Bander are pointed out. (auth)

18237 (JINR-P2-8238) SCALE TRANSFORMATION AND ASYMPTOTIC BEHAVIOR OF FORM FACTORS. Dao Vong Dyc. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The asymptotic behavior of form factors is considered in the framework of the theory of scale invariance. This is made on the basis of the scale transformation law of the current and of the conformal covariant operator product expansion near the light cone, as well. (auth)

18238 POSSIBLE CONNECTION BETWEEN SPIN ANALYTICITY AND $SU_{1,1}$ INVARIANCE OF DUAL-RESONANCE MODELS. Gabbiati, T. (Univ., Rome). Nuovo Cim.; 24A: No. 4, 449-458(21 Dec 1974).

The origin of the projective invariance underlying the dual-resonance models is investigated in terms of "spin analyticity" assumption on the external particles. This is realized by assigning them to unitary, irreducible representations of $SU_{1,1}$. The final result reproduces the Veneziano amplitude for external spinning particles. (auth)

18239 ELEMENTARY PARTICLES IN A CURVED SPACE. II. Fronsdal, C. (Univ., Trieste, Italy). Phys. Rev., D; 10: No. 2, 589-598(15 Jul 1974).

This is an attempt to develop conventional, contemporary, elementary-particle physics in a Riemannian space of constant curvature. The global structure of the 3 + 2 de Sitter space is studied, which is taken to mean the covering space of the hyperboloid $y_0^2 - \bar{y}^2 + y_5^2 = \rho^{-1}$ in a five-dimensional Minkowski space. This space is not periodic in time. A causal structure is shown to exist and the commutation relations between free fields are shown to be causal. Elementary massive particles are associated with a class of irreducible representations of the universal covering group of SO(3,2) for which the Hamiltonian has a discrete spectrum with a lower (positive) bound. A detailed study is made of the wave functions in "momentum space" and in configuration space. Free quantum fields are introduced with the help of a discrete set of creation and destruction operators and the commutator $[\phi_0(x), \phi_0(x')]$ is calculated. A description is given of what is thought to be an interesting way to realize irreducible representations of the "discrete series." (auth)

18240 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 23, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 98p.

18241 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 22, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 104p.

18242 RECENT PROGRESS IN GAUGE THEORIES OF THE WEAK, ELECTROMAGNETIC AND STRONG INTERACTIONS. Weinberg, S. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). Rev. Mod. Phys. 46: No. 2, 255-277 (Apr 1974).

A review is presented of progress since mid–1972 in the development of gauge theories of the weak, electromagnetic, and strong interactions. A brief introduction to the history and the fundamentals of the subject is also provided. (auth)

18243 REMARKS ON THE NEW RESONANCES AT 3.1 AND 3.7 GeV. Callan, C.G.; Kingsley, R.L.; Treiman, S.B.; Wilczek, F.; Zee, A. (Jadwin Physical Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. Lett. 34: No. 1, 52-56 (6 Jan 1975).

This is a collection of comments which may be useful in the search for an understanding of the recently discovered narrow resonances at 3.1 and 3.7 GeV. (auth)

18244 POSSIBLE INTERACTIONS OF THE J PARTICLE. Nieh, H.T. (Institute for Theoretical Physics, State University of New York, Stony Brook, New York 11794); Wu, T.T.; Yang, C.N. Phys. Rev. Lett. 34: No. 1, 49-52 (6 Jan 1975).

We discuss some possible interaction schemes for the newly discovered particle J and their experimental implications, as well as the possible existence of two J^0's like the $K_s - K_L$ case. Of particular interest is the case where the J particle has strong interactions with the hadrons. In this case J can be produced by assoicated production in hadron–hadron collisions and also singly in relative abundance in *ep* and *μp* collisions. (auth)

18245 FEW BODY PROBLEMS IN NUCLEAR AND PARTICLE PHYSICS. Summaries of Contributed Papers. International Conference Held at Quebec City, Quebec, August 27–31, 1974. Slobodrian, R. J. (ed.). Quebec, Laval University (1974). 141p. (In French and English).

Abstracts are given of a large number of papers on general few body problems, nucleon-nucleon interaction at all energies, meson-nucleon and meson-deuteron interactions, meson factories programs, nuclear bremsstrahlung, on-shell and off-shell interactions, final-state interactions, bound and scattering states, few-body forces, polarization phenomena, short range correlations, quasi-free scattering, composite hadron models, subnucleon structure, multiparticle and coherent production processes, break-up reactions, electrodisintegration, and relativistic effects. (ECB)

18246 SUPERSELECTION STRUCTURE OF PARTICLE PHYSICS. Haag, R. (Univ., Hamburg). J. Phys. (Paris), Colloq.; No. 1, 107-110(1973).

From 2nd international conference on elementary particles; Aix-en-Provence, France (6 Sep 1973).

The origin of charge quantum numbers and statistics in relativistic local quantum theory with short range forces and the classification of the possibilities allowed by the basic principles are discussed. (auth)

18247 THEORY OF INTERACTION DURATION IN THE PROCESS OF SCATTERING AND THE THRESHOLD OF MULTIPARTICLE PROCESSES. Perel'man, M. E. (Inst. of Cybernetics, Tbilisi, USSR). Dokl. Akad. Nauk SSSR; 214: No. 3, 539-542 (21 Jan 1974). (In Russian).

The relation of the interaction duration operator Q to the particle propagators in elastic scattering process $A + B \rightarrow A + B$ was established in the framework of the nonrelativistic scattering theory. The decay time in the scattering process on the lifetime of the quasiparticle AB was expressed by the total cross section of the A + B reaction. It was shown that the value of the lifetime determines with increase of the current density of the A particles the threshold for opening up new channels and types of reactions because with increase of the current density the quantity of metastable quasiparticles increases. (JSR)

Electromagnetic

Refer also to abstracts 18675 and 18724.

18248 (AD-782206) PHOTONS/TACHYONS IN FRESNEL'S EVANESCENT WAVE: CONSERVATION OF MOMENTUM/ENERGY IN DIPOLE ABSORPTION/EMISSION. Costa de Beauregard, O. Translated by E. V. Osgood from Compt. Rend., Ser. B; 270: 1004-1007(1970). 8p. (NRL-Trans-1295). NTIS $3.00.

The discussion covers translations, quantum theory, Fresnel zones, evanescent waves, and emission spectra. (JFP)

18249 (COO-3285-16) RESEARCH IN THEORETICAL PHYSICS. Annual Report. (Johns Hopkins Univ., Baltimore, Md. (USA). Dept. of Physics). Dec 1974. Contract AT(11-1)-3285. 15p. Dep. NTIS $4.00.

Research on the treatment of coordinates as dynamical variables, nonperturbative methods in quantum field theory, and phenomenological investigation of the $\bar{e}e$ annihilation problem, including the recently discovered narrow resonant states is summarized. (JFP)

18250 (DESY-74/56) LESSONS ON e^+e^- ANNIHILATION FROM SIMPLE CHAIN EMISSION MODELS. Craigie, N. S.; Walsh, T. F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nov 1974. 52p. Dep. NTIS $5.75.

The dearth of solvable models for e^+e^- annihilation often reduces one to excessively qualitative considerations, leaving obvious dynamical questions open. Various aspects of chain-emission models are discussed which can be cast into solvable form. In such models the virtual photon decays into a link (a pion, for example) and some state (e.g. an off-shell vector meson) which decays by sequentially shedding further links. Topics include the scaling behavior in such models (including how it is broken near $\omega = 0$); neutral/charged distributions; the effect of internal quantum numbers and, in a particularly simple version of the model, the two-particle distributions. In particular, it is shown how a large neutral to charged energy ratio can arise. Finally, variants on such models arising from possible variety in the links of the chain, (i.e. multichannel effects), and also the nonlinear effects arising from the branching of a chain into chains are discussed. (auth)

18251 (DESY-74/57) PHOTOPRODUCTION AND THE NONRELATIVISTIC QUARK MODEL. Barbour, I. M.; Moorhouse, R. G.; Malone, W. A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Dec 1974. 17p. Dep. NTIS $4.00.

A previous analysis of photoproduction is extended in a model-dependent fashion beyond the third resonance region; and the mechanisms governing this striking cancellation between the contributions of the low and medium energy resonances and the Born terms in the dispersion relations, should this continue, are investigated. (JFP)

18252 (IC-72-113) SOFT BREMSSTRAHLUNG STRUCTURE FUNCTION. Rai Choudhury, S.; Rotelli, P. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1972. 8p. INIS.

Low's theorem is used to express the soft photon structure function in terms of the single- and double-charged particle structure functions. With the simplifying assumption that asymptotically the hadronic particles cluster (in the center-of-mass frame) in sharp forward and backward cones, a simple explicit form is obtained for the soft bremsstrahlung structure function. The question of scaling is discussed. (auth)

18253 (IC-73-106) THEORY OF THE ELECTROMAGNETIC STRUCTURE FUNCTIONS OF THE PROTON. Baiquni, A.; Barut, A. O. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1973. 17p. INIS.

The knowledge of the wave function of a relativistic composite system constitutes a complete description of its intrinsic properties such as mass spectrum, elastic and inelastic form factors and structure functions. The wave functions of the proton obtained from the 0(4,2) infinite multiplet model, which were used previously to calculate mass spectra and form factors, are applied to re-evaluate in a more complete manner the structure functions in closed form. The resultant scaling functions obey the Drell–Yan relation $F_2(\xi) \sim (1 - \xi)^3$ and, approximately, the Callan–Cross relation $F_2(\xi) = 2\xi F_1(\xi)$. (auth)

18254 (ITP–73-30E) QUASI-INDEPENDENT QUARK MODEL AND HADRON ELECTROMAGNETIC FORMFACTORS AT LARGE TRANSFERRED MOMENTS. Dushenko, F. F.; Kobushkin, A. P. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1973. 11p. INIS.

The asymptotic behavior of electromagnetic bound state form factors of three scalar quarks at large transferred momenta k^2 in a quasi-independent quark model is investigated. An agreement of the model with the dipole approximation is found. (auth)

18255 (JINR–E2-8311) AZIMUTHAL DEPENDENCE OF THE INCLUSIVE ELECTROPRODUCTION. Kotzinian, A. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 12p. Dep. NTIS $4.00.

Kinematics of the process of inclusive electroproduction is discussed. On the basis of the generalization of the Mueller's theorem for the case of polarized beams, light-cone analysis gives asymptotic forms of all structure functions in the deep inelastic target fragmentation region. In this region the cross section is independent of the azimuthal angle. (auth)

18256 CURRENT ALGEBRA, PCAC, ITS ANOMALY, AND THE TWO-PHOTON PROCESS (SOFT-PION PRODUCTION BY TWO PHOTONS). Terazawa, H. (Stanford Linear Accelerator Center, CA). J. Phys. (Paris), Colloq.; No. 2, 61-67(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

Various applications of the current algebra, PCAC (partially conserved axial-vector current hypothesis) and its anomaly to the hadron production by two photons ($\gamma + \gamma \rightarrow$ hadrons) are reviewed. They include the processes (1) $\gamma + \gamma \rightarrow \pi^0, \eta, \eta'$ (or X^0) and ϵ; (2) $\gamma + \gamma \rightarrow 3\pi^0, \pi^+ + \pi^- + \pi^0$; and (3) $\gamma + \gamma \rightarrow n\pi^+ + n\pi^-$ (n = 1, 2, 3, . . .), where all produced pions are soft. Asymptotic behavior of the processes (4) $\gamma^* + \gamma^* \rightarrow \pi^+ + \pi^-$ and (5) $\gamma^* + \gamma^* \rightarrow \pi^0$ for highly virtual photons is also discussed. (auth)

18257 HADRONIC PHYSICS OF PHOTON–PHOTON COLLISIONS. Brodsky, S. J. (Stanford Linear Accelerator Center, CA). J. Phys. (Paris), Colloq.; No. 2, 69-75(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

Measurements of photon-photon cross sections ($\sigma(\gamma\gamma \rightarrow$ hadrons)) can determine the important C = + hadronic states and resonances, and test fundamental ideas of Regge theory, two-component duality, and the effects of local two photon interactions. Measurements of the specific channels $\gamma\gamma \rightarrow \pi\pi$ and KK allow a unique probe of the meson Compton amplitude and can determine the $\pi\pi$ scattering lengths and phase shifts. The theoretical expectations for these processes are reviewed, and new predictions for fixed angle scaling laws and the π^0 transition form factor derivable from quark-theoretic models are discussed. (auth)

18258 $\gamma\gamma \rightarrow$ HADRONS: ASYMPTOTIC BEHAVIOR AND DEEP INELASTIC SCATTERING. Walsh, T. F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg). J. Phys. (Paris), Colloq.; No. 2, 77-85(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

Photon-photon collisions are discussed under three rubrics: Two real or nearly real photons (the process is then dominated by the "hadronlike" character of these photons). One real or nearly real photon and one far off-shell photon (deep inelastic scattering on a real photon). Two far off-shell photons (the reaction then has some similarity with $e^+e^- \rightarrow \gamma^* \rightarrow$ hadrons). Various models (in particular Regge and partons) are considered. (auth)

18259 COULOMB AND PHOTON EFFECTS AT HIGH ENERGY. Stodolsky, L. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). J. Phys. (Paris), Colloq.; No. 2, 87-95(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

Coulomb production effects such as the Primakoff effect and its generalization are reviewed. It is shown that such effects could be used to study total cross sections of elementary particles with the photon. The very high energy behavior of various photon-exchange mechanisms is reviewed. Finally it is pointed out that a large and growing cross section for "hard" photon production should exist in hadron collisions. (auth)

18260 EQUIVALENT PHOTON APPROXIMATION IN ONE- AND TWO-PHOTON EXCHANGE PROCESSES. Kessler, P. (College de France, Paris). J. Phys. (Paris), Colloq.; No. 2, 97-107(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

The historical development of the equivalent photon (Williams-Weizsaecker) approximation is reviewed, starting from its semiclassical derivation. Its application to the nuclear interactions of underground cosmic-ray muons and to the inelastic scattering of various (hadronic or nonhadronic) particles in the Coulomb field to nuclear targets is considered. A field-theoretical derivation to the Williams-Weizsaecker formula, based on helicity, is given for the one-photon exchange case and then extended to the two-photon exchange case ("photon-photon collisions"). Its conditions of validity are briefly discussed, and some numerical tests, are shown or mentioned. (auth)

18261 FORMULATION AND VALIDITY OF AN EQUIVALENT PHOTON APPROXIMATION IN THE TWO-PHOTON EXCHANGE MECHANISM. Bonneau, G.; Gourdin, M.; Martin, F. (Univ., Paris). J. Phys. (Paris), Colloq.; No. 2, 109-111(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

An equivalent photon approximation is studied for the two-photon exchange mechanism in the inelastic Bhabha scattering $e^+e^- \rightarrow e^+e^- + \Gamma$ particular cases of final state Γ are considered: $\Gamma = \mu^+\mu^-$; $\Gamma = \pi^0, \eta, \eta'$. (auth)

18262 EQUIVALENT PHOTON APPROXIMATION. Lyth, D. H. (Univ. of Lancaster, Eng.). J. Phys. (Paris), Colloq.; No. 2, 113-114(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

A set of conditions which must be satisfied in order to make the equivalent photon spectrum (and also the virtual photon's polarization) Lorentz-invariant is established. Special interest is devoted to the fact that the condition that the virtual photon emission angle must be small. (auth)

18263 BEYOND THE EQUIVALENT-PHOTON APPROXIMATION. Subbarao, K. (Cornell Univ., Ithaca, NY). J. Phys. (Paris), Colloq.; No. 2, 115-117(1974).

From international colloquium on photon–photon collisions in electron–positron storage rings; Paris, France (3 Sep 1973).

When the cross section for the process ee → eeX for a given arbitrary hadronic state X is considered more accurately than in the equivalent-photon approximation, important terms arise. These terms, expressible in terms of the helicity amplitudes for the process $\gamma\gamma \rightarrow X$ with virtual photons, are discussed. (auth)

18264 DUALITY IN INELASTIC EP SCATTERING. Konishi, K. I. (Scuola Normale Superiore, Pisa, Italy). Nuovo Cim.; 24A: No. 4, 459-482(21 Dec 1974).

It is shown that a phenomenological Veneziano-like amplitude for the virtual Compton scattering can be regarded as an explicit solution of the Bloom-Gilman's fixed-q^2 FESR. A semi-phenomenological analysis of ep inelastic scattering is given using this amplitude. The question about the role of the diffractive component in the Bloom–Gilman duality is raised, and it is suggested that there might be a considerable amount of the diffractive component in the virtual Compton amplitude such that it preserves the fixed-q^2 FESR and the threshold relation. (auth)

18265 PION ELECTROPRODUCTION IN A DUAL B_5-MODEL WITH FIXED POLES. Actor, A.; Koerner, J. G.; Bender, I. (Univ., Heidelberg). Nuovo Cim.; 24A: No. 4, 369-390(21 Dec 1974).

An explicitly dual model is constructed for pion electroproduction based on a dual B_5-model previously developed for pion photoproduction. The basic continuation problem in k^2 (k is the virtual-photon four-momentum) is examined in detail. It is found that important direct- and cross channel pole structures constrain the continuation quite strongly. One is led to an essentially unique electroproduction ansatz which fits the available (small t, moderately large s) data rather well. In the region of these data the model behaves qualitatively like an electric Born-term model with a flat nucleon form factor and a vector dominance pion form factor. (auth)

18266 DISCUSSION OF THE DEVELOPMENT OF A THEORY OF ELECTRON–DEUTERON SCATTERING IN THE QUASI-ELASTIC REGION, AND ITS APPLICATION TO THE DETERMINATION OF THE ELECTROMAGNETIC STRUCTURE OF THE NEUTRON. Myer, D. M. University Park, PA; Pennsylvania State Univ. (1974). 125p. University Microfilms Order No. 74-28,973.

Thesis (Ph.D.).

The problem of electron–deuteron scattering is introduced and considers theories of this interaction in the quasi-elastic region and their application to determinations of the electromagnetic structure of the neutron. The general characteristics of electron–deuteron scattering are discussed, as well as an overview of experimentation in this field. Then, the theoretical problem of electron–deuteron scattering of the quasi-elastic peak is formulated, and a theoretical approach toward the determination of the neutron form factors is developed in detail. A mathematical statement for the electron–deuteron cross section is developed, and an examination is made of the various ways in which the theory can be used to determine the neutron electromagnetic form factor. The interactions between the electron and the deuteron are assumed to proceed through the process of one photon exchange; this allows the matrix elements to be written in terms of the product of the matrix element describing the interaction of the electron with the photon exchanged, and the matrix element describing the interaction of the photon with the deuteron. The discussion proceeds with considerations of electromagnetic current conservation and parity conservation. (Diss. Abstr. Int., B)

18267 MASSLESS VECTOR GLUONS IN A UNIFIED GAUGE THEORY OF WEAK, ELECTROMAGNETIC, AND STRONG INTERACTIONS. Itoh, C. Meiji Gakuin Univ., Tokyo); Minamikawa, T.; Miura, K.; Watanabe, T. Progr. Theor. Phys. (Kyoto); 51: No. 5, 1575-1584(May 1974).

Spontaneously broken SU(2) × U(1) × SU(3)′ gauge symmetry of weak, electromagnetic and strong interactions is given. All generators of SU(3)′ commute with those of ordinary SU(3). Fractionally charged twelve quarks are assigned to four triplets of SU(3)′. Possible unbroken SU(3)′ symmetry with massless gluon-like gauge bosons is suggested. Strong interactions are induced by these massless gluons. Leptons are assigned to singlets of SU(3)′ and so leptons have no strong interactions. Potentials due to massless gluons suggest low lying bound states (usual hadrons) for SU(3)′ singlet three-quark states and SU(3)′singlet quark-antiquark states. One massless gluon cannot be emitted in usual hadron processes. Two or more massless gluon emissions in usual hadron processes are suppressed. When quarks are observed, they should emit massless gluons easily. (auth)

18268 VECTOR–MESON PRODUCTION BY POLARIZED PHOTONS IN THE QUARK MODEL. Hayashi, M.; Katsura, K. (Saitama Medical Coll., Iruma, Japan). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1541-1550(May 1974).

Applying the quark model of photoproduction, a number of relations between the spin density matrix elements of the vector-mesons V^0 produced via $\gamma B \rightarrow V^0 B'$ by polarized photons are predicted. The quark-model relations are compared with the experimental data obtained at SLAC for $\gamma p \rightarrow \rho^0 p$, $\gamma p \rightarrow \omega p$ and $\gamma p \rightarrow \phi p$ at $E_\gamma = 2.8$, 4.7 and 9.3 GeV. The agreement of the quark-model predictions with the experimental data measured in the helicity system is very good for $\gamma p \rightarrow \rho^0 p$. For reactions $\gamma p \rightarrow \omega p$ and $\gamma p \rightarrow \phi p$, the agreement is good on the whole at three different values of energies over wide $|t|$ region. (auth)

18269 GENERALIZED INVARIANT FOR A CHARGED PARTICLE INTERACTING WITH A LINEARLY POLARIZED HYDROMAGNETIC PLANE WAVE. Roth, M. (Institut d'Aeronomie Spatiale, Brussels). Bull. Cl. Sci., Acad. Roy. Belg.; 60: 599-616(1974). (In French).

The effect of a linearly polarized hydromagnetic wave on the motion of a charged particle is considered. The wave propagation is in the direction of a uniform magnetic field. It is shown that when the wave amplitude is weak, it is possible to find a more general invariant than the magnetic moment. Applications to the magnetosphere and interplanetary space are noted. (JFP)

18270 FOUR-PHOTON PARAMETRIC INTERACTION IN THREE-LEVEL RESONANCE MEDIUM. Adonts, G. G.; Kocharyan, L. M.; Shakhnazaryan, N. V. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 4, 306-311(1974). (In Russian).

The passage of weak and strong waves through resonance medium consisting of three-level atoms was studied in nonrelaxation approach. Stark shifts of atoms in the field of a strong monochromatic wave are obtained. It is shown that the taking account of the third level leads to new intervals of four-photon parametric enhancement. (auth)

18271 THEORY OF RADIATION OF CHARGED PARTICLES IN ARBITRARY LAMINATED MEDIA. Magomedov, M. R.; Elbakyan, S. S. (Inst. of Physics, Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 4, 295-305(1974). (In Russian).

The solution of Maxwell equations in laminated media for arbitrary distributed external sources is obtained by Green function method. A simple and consistent method for the construction of Green functions in arbitrary laminated media is given. The parametrization of the characteristic matrix for laminated media in the form most convenient for applications is made. (auth)

18272 THEORY OF ULTRA-RELATIVISTIC CYCLOTRON AUTO-RESONANCE MASERS. Petelin, M. I. Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 6, 902-908(1974). (In Russian).

It is shown that the efficiency of induced cyclotron radiation of a stationary ultrarelativistic electron stream may amount to several tens of percent if the electromagnetic wave interacting with the stream propagates in the direction close to that of the static magnetic field and its phase velocity is close to the velocity of light. (auth)

18273 APPROXIMATION OF THE CROSS-SECTION ANGULAR DEPENDENCE FOR SINGLE PION PHOTOPRODUCTION ON A

NUCLEON WITHIN THE THRESHOLD TO 1.2 GeV ENERGY RANGE. Krivets, A. G.; Nikiforov, V. I.; Sanin, V. M.; Shalatskii, S. V. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 9, 1475-1480(Sep 1974). (In Russian).

A statistical processing of cross section angular distributions for photoproduction of single, π^+, π^0, π^--mesons on a nucleon is given within the photon energy range to 1.2 GeV. The angular distributions were approximated by the series $d\sigma/d\Omega = \Sigma A_k P_k(\cos\theta)$. A detailed picture is obtained for the energetic behavior of the series coefficients. The results are presented in the figures. (auth)

18274 FREQUENCY SPECTRUM OF X-RAY TRANSITION RADIATION FORMED IN A STACK OF PLATES. Garibyan, G. M.; Gevorgyan, L. A.; Yang, C. (Inst. of Physics, Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 4, 284-294(1974). (In Russian).

The routine of the integration over radiation angles of the formula for x-ray transition radiation formed in a finite regular stack is analyzed in detail. The formula obtained for the frequency spectrum is a generalization of the known one expressed in the form of a series. The flow chart for the calculation of the frequency spectrum is given. (auth)

18275 HEAVY QUARKS AND e^+e^- ANNIHILATION. Appelquist, T.; Politzer, H.D. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 34: No. 1, 43-45 (6 Jan 1975).

The effects of new, heavy quarks are examined in a colored quark—gluon model. The e^+e^- total cross section scales for energies far above any quark mass. However, it is much greater than the scaling prediction in a domain about the nominal two—heavy—quark threshold, despite $\sigma_{e^+e^-}$ being a weak—coupling problem above 2 GeV. We expect spikes at the low end of this domain and a broad enhancement at the upper end. (auth)

18276 COULOMB SCATTERING OF POLARIZED PARTICLES WITH SPIN 1 IN THE FIVE-DIMENSIONAL THEORY. Bedritskii, A. I. (Vitebsk Pedagogical Inst., USSR). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 5, 96-100(1972). (In Russian).

It was shown that the discrete physical property of particles and antiparticles n ± 1, introduced earlier with classification of the state of spin 1 particles on the basis of the five-dimensional equation, makes the helicity of particles and antiparticles relative in nature. This means that the five equations include a hypothesis on reflecting particles introduced earlier by other workers. On the basis of the five equations, which in some form of gravitational interaction opposed by electromagnetism, the problem is solved on the dispersion of polarized spin 1 particles a heavy Coulomb center. The same cross section is shown for ordinary (L) and R particles and also for particles and antiparticles. The $L \rightleftharpoons R$ transition does not occur in dispersion. After summarizing the final polarizations and averaging the initial, a cross section is obtained with a somewhat more complex angular dependence than on the corresponding cross section in the four-dimension theory but in the nonrelativistic limiting formula of Rutherford. (tr-auth)

18277 LEPTON PAIR PRODUCTION BY POLARIZED PHOTONS. Vescan, T. (Univ. of Bucharest). Rev. Roum. Phys.; 19: No. 8, 851-861(1974).

The production of lepton pairs by polarized photons is studied by assuming a Bethe—Heitler mechanism. A detailed analysis of the elastic case ($\gamma + p \rightarrow 1^+ + 1^- + p$) for a polarized target is carried out. The general inelastic (inclusive) reaction ($\gamma + p \rightarrow 1^+ + 1^-$ + anything) is also considered. (auth)

18278 TOTAL CROSS SECTIONS OF HADRON ABSORPTION OF PHOTONS BY PROTONS AT 12 TO 30 GeV. Belousov, A. S.; Budanov, N. P.; Govorkov, B. B. (Lebedev Inst. of Physics, Moscow). Dokl. Akad. Nauk SSSR; 215: No. 1, 76-78(1 Mar 1974). (In Russian).

The hadron absorption of photons was made on the electron beam of the proton synchrotron of the Institute of High-Energy Physics. In the liquid hydrogen target the electrons emit bremsstrahlung, whose photons interact with the protons of the target. The separation of the hadron absorption from a background of processes accompanying very intense electromagnetic absorption was done with hadron detectors. The results obtained were shown graphically and compared with previous experimental and theoretical data. (JSR)

18279 EQUILIBRIUM SPECTRA OF ELECTRONS AND PHOTONS IN LEAD AND AIR. Kol'chuzhkin, A. M.; Bespalov, V. I. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 5, 151-154(1974). (In Russian).

The equilibrium spectra of cascade electrons and photons generated by primary electrons were calculated by the Monte Carlo method. The process of photon energy degradation was simulated directly but the electron transfer was examined in the framework of the catastrophic collision model. The results obtained for the differential energy spectra of electrons and photons in Pb and in air are shown graphically. (JSR)

18280 WIGNER QUANTUM DISTRIBUTION FUNCTION OF AN ELECTRON GAS IN CROSSED ELECTRICAL AND MAGNETIC FIELDS. Gorshenkov, V. N. (Gorky Research Physical-Technical Inst.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 5, 123-124(1974). (In Russian).

The Wigner quantum distribution function is determined for a nondegenerate gas of free electrons existing in crossed homogeneous and constant electric and magnetic fields. (JSR)

18281 NONRELATIVISTIC COMPTON AMPLITUDE. Friar, J.L.; Fallieros, S. (Department of Physics, Brown University, Providence, Rhode Island 02912). Phys. Rev. C 11: No. 1, 277-279 (Jan 1975).

A simple heuristic argument is made which demonstrates the nonanalyticity of the nonrelativistic and semirelativistic forward Compton amplitudes for photon scattering from a bound particle. Hence, no dispersion relation can be written. The "no—retardation" theorem of Gerasimov is thus shown to be incorrect. A variety of topics associated with this problem are discussed. (auth)

18282 RELATIVISTIC AND RETARDATION EFFECTS IN THE THOMAS—REICHE—KUHN SUM RULE FOR A BOUND PARTICLE. Friar, J.L.; Fallieros, S. (Department of Physics, Brown University, Providence, Rhode Island 02912). Phys. Rev. C 11: No. 1, 274-276 (Jan 1975).

Relativistic and retardation corrections of lowest order are evaluated for the photoabsorption Thomas—Reiche—Kuhn (TRK) sum rule of a particle bound in a potential. It is found that the retardation corrections partially cancel and the remainder is canceled by part of the relativistic corrections. The latter corrections depend on the Lorentz—transformation properties of the potential. The complete integrated photoabsorption cross section, including first—order relativistic corrections, is found to be equal to the high—energy limit of the Compton amplitude calculated by Goldberger and Low, a result which is the dispersion—relation form of the TRK sum rule. A heuristic derivation of the latter results is presented. (auth)

Weak

Refer also to abstract 17823.

18283 (IC—73—58) PROGRESS REPORT ON A MODEL FOR WEAK INTERACTIONS. Fronsdal, C. (International Centre for Theoretical Physics, Trieste (Italy)). May 1973. 9p. INIS.

A model of weak interactions that shows a remarkable propensity for predicting finite results for weak damping of electromagnetic interactions and vice versa, without the help of any vector boson intermediaries is re-examined in the light of spontaneously broken symmetry models. A striking similarity with the Higgs—Kibble model leads to some new speculations, and the role of CVC and PCAC is pointed out. However, no elegant way was found to achieve a finite result for a fourth-order weak amplitude. (auth)

18284 (JINR—E2-8305) INVESTIGATION OF THE NEUTRAL CURRENTS IN THE PROCESSES OF THE NEUTRINO SCATTERING ON ATOMIC NUCLEI. Eramzhyan, R. A.; Folomeshkin, V. N.; Gershtein, S. S.; Khlopov, M. Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

The reactions of the nuclear level excitation by the neutrino of low and intermediate energies are analyzed in order to determine the isotopic structure of the neutral current. (auth)

18285 (JINR-P2-8207) NEUTRINO EXPERIMENTS AND NON-LOCAL THEORY OF WEAK INTERACTIONS. Sibold, K.; Mal'shkin, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

It is shown that the νe- and $\bar{\nu} e$-scattering experiments can be explained in the framework of nonlocal theory of weak and electromagnetic interactions. (auth)

18286 FORMULA OF THE DIFFERENTIAL CROSS SECTION FOR THE TRIDENT PRODUCTION. Homma, S. (Tokyo Univ., Tanashi, Japan); Itano, A.; Nishikawa, K.; Hayashi, M. J. Phys. Soc. Jap.; 36: No. 5, 1230-1235(May 1974).

The differential cross section for the lepton trident production in the Coulomb field of nucleus is calculated using a standard technique of quantum electrodynamics. Eight diagrams are taken into account in the calculation. The cross section formula in the text is expressed in the form which is most suitable for any type of numerical calculation. Since the formula is expressed in order to make the calculation of individual diagrams possible, one can easily evaluate the contribution of certain diagrams to the cross section at a given experimental geometry. Propagator terms are expressed separately from the others making the modification of this part possible. Numerical calculation of the formula at a given experimental geometry shows a complete agreement with the one of the formulas derived independently by Henry. (auth)

18287 LEPTON-COUNTING SUM RULES FOR NEUTRINO-BARYON SCATTERING. Kurokawa, H. (Hiroshima Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 2, 561-570(Feb 1974).

In the urbaryon model (Hiroshima model) proposed by Hayashi, Koide and Ogawa where urbaryons are related with lepton pairs, it is postulated that the constituent leptons within hadrons are scattered independently in high energy collisions with neutrinos. This postulate (lepton-counting hypothesis) leads one to sum rules for differential and total cross sections for neutrino-baryon scattering. A sum rule is examined by using presently available experimental data. In the Hiroshima model, the lepton-counting hypothesis implies that $\nu_e - \nu_\mu$ universality is violated. A modification of Hiroshima model to recover $\nu_e - \nu_\mu$ universality, is proposed, and it is shown that the breaking of this universality is connected with the appearance of the $n_0 - \lambda_0$ two-body transition. An experimental discrimination among urbaryon models, where urbaryons are composed of the leptons and the B^+-matter is suggested. (auth)

18288 SCHEME OF TWO UNITARY TRIPLETS OF THE INTERMEDIATE BOSONS AND WEAK INTERACTIONS. Shito, O. (Nihon Univ., Funabashi, Japan). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1559-1574(May 1974).

A unified model of weak interactions is proposed on the basis of Cabibbo's and d'Espagnat's approaches. Basic assumptions are: a) there exist two kinds of unitary triplets W_1 and Z_1 of intermediate spin-one bosons with required large masses and b) their fundamental weak interactions are ascribed to the fundamental representations of the unitary group which is conjugate to the symmetry group of strong interactions. By introducing a heavy lepton, a unitary triplet scheme of leptons is assumed to realize this picture. The following coupling scheme is obtained from these hypotheses: a) The usual nonleptonic decays are treated independently of ordinary leptonic ones, b) the leptonic couplings consist of the usual charged part which contains Cabibbo's picture, a neutral part which does not contribute to any $|\Delta S| = 1$ semi-leptonic transitions involving usual leptons and further a new charged part in which heavy leptons always participate and c) the nonleptonic couplings provide the same result as d'Espagnat's one except for coupling strength. These features can be consistent with experiment. In addition, a discussion is given for the effects of violation of P and CP invariances as well as of the $\Delta I = \frac{1}{2}$ rule, by the use of chiral groups and mass-type interactions of the intermediate bosons. (auth)

18289 INTERMEDIATE BOSON IN THE FERMION–CURRENT MODEL OF NEUTRAL CURRENTS. Sakurai, J.J. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. Lett. 34: No. 1, 56-58 (6 Jan 1975).

The intermediate–boson version of the earlier proposed fermion–current model of neutral currents is discussed. In particular I speculate on the possibility that the recently discovered 3.105–GeV particle may be identified with the intermediate boson of the fermion–current model. (auth)

18290 POSSIBLE EXPLANATION OF THE NEW RESONANCE IN e^+e^- ANNIHILATION. Borchardt, S.; Mathur, V.S.; Okubo, S. (University of Rochester, Rochester, New York 14623). Phys. Rev. Lett. 34: No. 1, 38-40 (6 Jan 1975).

We propose that the recently discovered resonance in e^+e^- annihilation is a member of the $15 \oplus 1$ dimensional representation of the SU(4) group. This hypothesis is consistent with the various experimental features reported for the resonance. In addition, we make a prediction for the masses of the charmed vector mesons belonging to the same representation. (auth)

18291 INTERPRETATION OF A NARROW RESONANCE IN e^+e^- ANNIHILATION. Schwinger, J. (University of California at Los Angeles, Los Angeles, California 90024). Phys. Rev. Lett. 34: No. 1, 37-38 (6 Jan 1975).

A previously published unified theory of electromagnetic and weak interactions proposed a mixing between two types of unit–spin mesons, one of which would have precisely the characteristics of the newly discovered neutral resonance at 3.1 GeV. With this interpretation, a substantial fraction of the small hadronic decay rate can be accounted for. It is also remarked that other long–lived particles should exist in order to complete the analogy with ρ^0, ω, and φ. (auth)

18292 FACT AND FANCY IN NEUTRINO PHYSICS. Rújula, A.D.; Georgi, H.; Glashow, S.L.; Quinn, H.R. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). Rev. Mod. Phys. 46: No. 2, 391-407 (Apr 1974).

This paper reviews the success of the quark model in describing deep–inelastic lepton scattering. The neutral current predictions of a variety of unified gauge models are given, and it is shown how experiment may distinguish among them. All the models involve new hadronic quantum numbers (charm or fancy). Their effects at high energy are explored. (auth)

18293 A STUDY OF NEUTRINO PRODUCTION OF NUCLEON ISOBARS IN THE QUARK MODEL. Andreadis, P.; Baltas, A.; Le Yaouanc, A.; Oliver, L.; Pène, O.; Raynal, J.C. (Laboratoire de Physique Théorique et Hautes Energies, Orsay, France). Ann. Phys. (N.Y.) 88: No. 1, 242-285 (Nov 1974).

A complete description of the predictions of the harmonic oscillator quark model for the process $\nu N \rightarrow \mu N^*$ (N^* being any nucleon isobar), based on multipole expansion, is given. General formulae are obtained for the reduced matrix elements of the multipole operators. A yet unformulated set of selection rules for the axial part of the matrix element is thus obtained. For the $\Delta(1236)$, in addition to the well–known Becchi and Morpurgo selection rule $E_2{}^V = 0$ for the vector part, one gets $M_2{}^A = 0$ for the axial part. Owing to the presence of large momentum transfers, a relativistic treatment of the hadron center of mass motion is introduced, which consists in boosting the SU(6) harmonic oscillator wavefunctions at rest. The physical structure of the quark weak current is described by the dominance of the corresponding intermediate $q\bar{q}$ bound states ρ and π, A_1. Quantitative predictions are obtained for multipole amplitudes, cross sections and density matrices, without any free parameter (the harmonic oscillator radius R^2 is fixed independently). Comparison is made with experiment as far as possible. Careful comparison of the model is made with models based on nucleon exchange (static model, Adler's model). We also compare with other works in the quark model. (auth)

18294 GAUGE THEORIES OF WEAK INTERACTIONS (CIRCA 1973–74 C.E.). Beg, M. A. B. (Rockefeller Univ., New York); Sirlin, A. Annu. Rev. Nucl. Sci.; 24: 379–449(1974).

This somewhat selective review of developments deals primarily with the problems of weak interactions. The phenomenological structure of weak interactions as embodied in the Feynman–Gell–Mann theory is reviewed, and both the Universal Fermi and the Intermediate Vector Boson versions of the theory are discussed. Difficulties plaguing these theories are pinpointed, and some early attempts to surmount them are reviewed. Then the Higgs–Kibble mechanism is briefly described, the methodology of gauge theories is discussed, and the way in which the gauge approach yields the proper high-energy behavior for weak amplitudes to resolve the unitarity problems of conventional theory is demonstrated. Next, radiative corrections and high-order weak effects are considered in the gauge-theoretic context, in particular, the stability of gauge theories under inclusion of these effects. "Natural" and "artificial" symmetries are discussed. Then a survey of gauge models is given. Experimental matters are presented, and the status of various models is examined in the light of some recently reported measurements on neutral currents. Finally, some of the unsolved problems in the field are recounted, and the future outlook is assessed. (8 figures, 2 tables, 179 references) (RWR)

Strong (General)

Refer also to abstract 18706.

18295 (FERMILAB-Conf-74/97) RECENT RESULTS ON NUCLEON DIFFRACTIVE DISSOCIATION. Mukhin, S. V.; Tsarev, V. A. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Sep 1974. 51p. (CONF-740933-3). Dep. NTIS $5.75.

From meeting of the Division of Particles and Fields of the American Physical Society; Williamsburg, Virginia, USA (5 Sep 1974).

Results on diffractive dissociation of nucleons in nucleon–nucleon and nucleon–nuclei collisions at high energies and small momentum transfer are reviewed. The π- and K-induced diffractive dissociation is briefly mentioned also. The diffractive dissociation into low and high mass states is discussed separately, the division being at 3 GeV. (JFP)

18296 (IC–74-24) PERTINENCE OF THE SEMIGROUP LAW IN THE THEORY OF THE DECAY OF AN UNSTABLE ELEMENTARY PARTICLE. Ali, S. T.; Fonda, L. (International Centre for Theoretical Physics, Trieste (Italy)). Apr 1974. 17p. INIS.

The problem of the decay of an unstable elementary particle is analyzed from the point of view of a quantum mechanical theory of randomly repeated measurements. A semigroup law of evolution, on the space of all density matrices, is shown to result.

This situation is contrasted with some earlier work on the problem where a semigroup law of evolution on a Hilbert space of state vectors was postulated. Many of the difficulties of this older theory are naturally resolved within the context of the currently proposed theory. (auth)

18297 (ITF-73-83E) FRESH LOOK AT THE STATISTICAL BOOTSTRAP MODEL. Gorenshtein, M. I.; Miranskii, V. A.; Sheiest, V. P.; Zinov'ev, G. M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1973. 10p. INIS.

A new interpretation of the statistical bootstrap model is proposed on the basis of which the statistical bootstrap equation is modified. A deep relation between the statistical bootstrap model and the Pomeranchuk model for multiple hadron production is established, and as a result of the significance of the volume V in the statistical bootstrap model is elucidated. (auth)

18298 (JINR-P2-8312) MULTIPLICITY DISTRIBUTION OF PIONS IN THE STATISTICAL BOOTSTRAP MODEL (BSM) WITHOUT ALLOWING FOR EXOTIC STATES. Kripfganz, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The multiplicity distribution is investigated in the decay of the fireballs into pions in the statistical bootstrap model without allowing for exotic states. An asymptotic form was found for this case. The decay chain is shown to modify insignificantly the relative probabilities. The comparison of this model results with those of the statistical bootstrap model is performed taking into account the exotic states. (auth)

18299 MULTIPLICITY DISTRIBUTIONS AND NORMALIZED CUMULANTS OF LOW- AND HIGH-ENERGY HADRON-HADRON SCATTERING. Giovannini, A. (Univ., Turin); Antich, P.; Calligarich, E.; Cecchet, G.; Dolfini, R.; Impellizzeri, F.; Ratti, S. Nuovo Cim.; 24A: No. 4, 421-437(21 Dec 1974).

A systematic comparison of the predictions of two phenomenological formulas with the available data is performed, considering both the charged-particle multiplicity distributions and the normalized cumulants. (auth)

18300 ETA SUPPRESSION AND THE QUARK MODEL FOR PARTICLE RATIOS. Rotelli, P. (Queen Mary Coll., London). Nuovo Cim.; 24A: No. 4, 483-493(21 Dec 1974).

A generalization of the additive quark model applied to multiparticle production is reconciled with the suppression of η and η' mesons by postulating the dominance of resonances in the central region. A number of consequences are discussed. (auth)

18301 RELATIVISTIC COMPOSITE MODEL CONSISTENT WITH THE BETHE-SALPETER EQUATION, APPROXIMATE SU(6) SYMMETRY AND DUALITY. II. Machida, S. (Kyoto Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1551-1558 (May 1974).

It is shown that the Bethe-Salpeter equation with the interaction kernel determined by the dual realistic quark model does not have solutions of scalar and axial vector types with respect to spinor indices. The reason why only the pseudoscalar and vector type solutions exist is clarified. It is concluded, therefore, that the theory allows only the SU(6) type solutions for one-meson states at rest. The interaction kernel prohibits naturally quarks from appearing as free particles in the incoming and outgoing states. Normalization of the solutions is discussed. The theory becomes much simpler by taking the mass of the quark to be infinity at the last stage of calculation, the remaining parameters being the coupling constant, slope and zero intercept of the leading orbital Regge trajectory. It is suggested that this limit may have some connections with the dual string model where end points of the string are interpreted to be the valence quark and antiquark which carry the degrees of freedom of unitary spin, spin, and spatial coordinates. (auth)

18302 MODEL WITH THREE CHARMED QUARKS. Barnett, R.M. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 34: No. 1, 41-43 (6 Jan 1975).

The spectroscopy and weak couplings of a quark model with three charmed quarks are discussed in the context of recent results from Brookhaven National Laboratory, Stanford Linear Accelerator Center, and Fermi National Accelerator Laboratory. (auth)

Strong (Baryon No. = 0)

18303 (IC-73-23) A AND MESONS FROM THE VIOLATION OF LOCAL LORENTZ INVARIANCE. Kenji, H. (International Centre for Theoretical Physics, Trieste (Italy)). 1973. 12p. INIS.

A skew-symmetric field and its dual field are quantized by requiring Lorentz invariance and the positive definiteness of the Hamiltonian. When they are massless they describe scalar and pseudoscalar particles, respectively, i.e., $h^{PC} = 0^{++}$ and 0^{--} (h denotes helicity). If they acquire their mass, then they become axial vector ($J^{PC} = 0^{++}$, like the A meson) and vector ($J^{PC} = 0^{--}$, like the β meson), respectively. The lowest-order Lagrangian may be derived from a generally covariant Lagrangian for the gravitational field, previously proposed. (auth)

18304 (ORO-3992-201) LEPTONIC DECAYS OF VECTOR MESONS IN SU(4). Dicus, D. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1975. Contract AT(40-1)-3992. 6p. (CPT-245). Dep. NTIS $4.00.

The sum rule on the decay of vector mesons into lepton pairs is shown to be brought into good agreement with experiment by assuming the new $\psi(3105)$ particle is a member of a basic SU(4) multiplet of vector mesons. (auth)

18305 NUCLEON-NUCLEON TWO-PION-EXCHANGE. Bohannon, G. E. East Lansing, MI; Michigan State Univ. (1974). 192p. University Microfilms Order No. 74-27,389.

Thesis (Ph.D.).

The J = 0,1,2 $N\bar{N} \to \pi\pi$ amplitudes were evaluated in the pseudophysical region $t \geq 4\mu^2$ and used in a calculation of nucleon-nucleon two-pion-exchange. The $\pi\pi$ phase shifts, which entered the calculation as the phases of the $t \geq 4\mu^2$ $N\bar{N} \to \pi\pi$ amplitudes, are discussed in detail. Results are given for several forms of the inputed I = J = 0 $\pi\pi$ phase shift δ_0^0. The imaginary parts of the J = 1 $N\bar{N} \to \pi\pi$ amplitudes were fitted with resonance expressions to determine the ρNN coupling constants as defined at the rho meson pole. The values found are $g^2_{\rho NN}/4\pi = 0.44 \pm 0.05$ and $f_{\rho NN}/g_{\rho NN} = 5.8 \pm 0.2$. The NN potential was calculated and shown along with the Hamada-Johnston[6] and nucleon box potentials. Various methods are discussed for finding the ωNN coupling constants based on the quark model and vector-meson-dominance. (Diss.Abstr. Int.,B)

18306 DIFFRACTION PEAK IN P-P ($\bar{P}$-P) SCATTERING AND GROWTH OF THE TOTAL CROSS SECTION. Minami, S. (Osaka City Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1424-1432(May 1974).

As the expression of σ_t for p-p scattering with which good fits to the data in the ISR energy range can be obtained, one considers two kinds of forms with the following properties: (i) σ_t does increase like $\log^2 (s/s_0)$ and (ii) σ_t tends to a finite value in the high energy limit. The scattering amplitude based on the dual absorptive model is modified by taking into account the effects of the growth of total cross section. It is shown that the experimental data for the slope parameter, σ_t and $d\sigma/dt$ in forward p-p scattering at $s = 40 \sim 2800$ GeV^2 can be explained well in terms of the modified amplitudes in both cases (i) and (ii). (auth)

18307 PHOTOPRODUCTION OF B MESONS IN COMPLEX ANGULAR MOMENTA MODEL AND MORRISON RULE. Amatuni, A. Ts.; Grigoryan, A. A. (Inst. of Physics, Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 4, 271-276(1974). (In Russian).

Predictions for the differential cross section of the photoproduction of B- and $B^\pm$-mesons in the model with p- and π-Regge poles and corresponding cuts are presented. (auth)

18308 ARE THE NEW PARTICLES BARYON-ANTIBARYON NUCLEI? Goldhaber, A.S. (Institute for Theoretical Physics, State University of New York, Stony Brook, New York 11794); Goldhaber, M. Phys. Rev. Lett. 34: No. 1, 36-37 (6 Jan 1975).

Baryon-antibaryon bound states and resonances could account for the new particles, as well as narrow states near nucleon-antinucleon threshold, which were reported earlier. (auth)

18309 IS BOUND CHARM FOUND? De Rújula, A. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138); Glashow, S.L. Phys. Rev. Lett. 34: No. 1, 46-49 (6 Jan 1975).

We argue that the newly discovered narrow resonance at 3.1 GeV is a $^3S_1$ bound state of charmed quarks and we show the consistency of this interpretation with known meson systematics. The crucial test of this notion is the existence of charmed hadrons near 2 GeV. (auth)

18310 SURVEY OF $\pi\pi$ AND $K\pi$ SCATTERING. Laurens, G. (CEN de Saclay, Gif-sur-Yvette, France). J. Phys. (Paris), Colloq.; No. 1, 217-219(1973).

From 2nd international conference on elementary particles; Aix-en-Provence, France (6 Sep 1973).

It is shown that much progress in the understanding of I = 0, I = 1 $\pi\pi$ phase shifts has been achieved, owing to some high statistics $\pi^- p \to \pi^+\pi^- n$ experiments and $2\pi^0$ production experiments. But I = 2 phases still remain imprecise, and the discrepancies appearing between the different methods for extracting Δ_0 raise the question of the respective advantages of the Chew-Low extrapolation and the amplitude analysis. A short study of results on $K\pi$ scattering is presented. (auth)

Strong (Baryon No. = 1)

18311 (CEA-N-1730) STUDY OF THE π-p → nγ REACTION IN THE REGION OF THE SO-CALLED ROPER RESONANCE. Codreanu, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1974. 126p. (In French). Dep. NTIS (U. S. Sales Only) $9.50.

Thesis. Submitted to Univ., Paris.

Electromagnetic interaction between hadrons is not well known as the smallness of the reaction cross sections makes it difficult to study. The reaction $\pi^-p \to n\gamma$ in the region of the so-called Roper resonance provides new results to test the invariance under time reversal and to investigate the $\Delta I = -1, 0, 1$ rule. Furthermore the coupling of the Roper resonance to this reaction, gives another clue to the classification of this resonance in the symmetry group representation. A well designed and reliable apparatus was necessary to study this reaction, especially in the presence of an important charge-exchange reaction ($\pi^-p \to \pi^0n$) background. The differential cross section for this reaction ($\pi^-p \to n\gamma$) is well represented by theoretical models which do not include $\Delta I = 2$ transitions. The coupling of the Roper resonance to the $n\gamma$ channel is compatible with its classification in an SU_3 octet. The comparison of the experimental data from the reactions $\pi^-p \to n\gamma$ and $\gamma n \to \pi^-p$ is in favor of time reversal invariance and the detailed balance hypothesis. (auth)

18312 (JINR-P1-8278) LONGITUDINAL PHASE SPACE ANALYSIS OF THE REACTION $\pi^-n \to \pi^-\pi^-\pi^+n$ AT ENERGY OF 5 GeV. Amglobeli, N. S.; Budagov, Yu. A.; Vinograv, V. B.; Volod'ko, A. G.; Dzhelepov, V. P.; Kladnitskii, V. S.; Kuznetsov, V. A.; Lomakin, Yu. F.; Salukvadze, R. G.; Flyagin, V. B.; Khubua, D. I.; Shandor, L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The longitudinal phase space (LPS) analysis of the reaction $\pi^-n \to \pi^-\pi^-\pi^+n$ was done. The results of the analysis show that the diffractive dissociation cross sections of the incident particle (pion) and the target (neutron) are constant within a wide energy interval from 5 to 16 GeV. On the other hand the cross section of the processes due to simultaneous dissociation of the incident pion and the target neutron decreases with the energy. (auth)

18313 (JINR-P1-8288) MULTIPLICITY OF SECONDARY PARTICLES PRODUCED IN THE DIFFRACTION AND NON-DIFFRACTION π^-p INTERACTIONS AT p = 40 GeV/c. Grishin, V. G.; Kerachev, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Multiplicity distributions of π^0-mesons and all secondary particles in the diffraction and nondiffraction π^-p -interactions at p = 40 GeV/c were obtained. The comparison of the obtained experimental results with the data for other energies shows that multiplicity scaling takes place for all secondary particles. (auth)

18314 (JINR-P2-8337) STUDY OF THE DEGREE SELF-SIMILAR ASYMPTOTICS OF THE MESON-NUCLEON SCATTERING AT LARGE ANGLES. Goloskokov, S. V.; Kuleshov, S. P.; Matveev, V. A.; Smondyrev, M. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 11p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A study is made of the degree self-similar asymptotics of the meson-nucleon scattering at large angles in the framework of the quasi-potential Logunov-Tavkhelidze approach. For analytical quasipotentials, satisfying the γ_5-invariance condition, the energy dependence of the differential scattering cross section was found. (auth)

18315 (LBL-3096) REACTION $\pi^-p \to \pi^0n$ BETWEEN 20 GeV/c AND 100 GeV/c. Barnes, A. V.; Mellema, D. J.; Tollestrup, A. V.; Walker, R. L.; Dahl, O. L.; Johnson, R. A.; Kenney, R. W.; Pripstein, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1974. Contract W-7405-eng-48. 34p. (CONF-740713-35). Dep. NTIS $4.75.

From 17th international conference on high-energy physics; London, UK (1 Jul 1974).

Preliminary $d\sigma/dt$ distributions are presented for the pion charge exchange reaction $\pi^-p \to \pi^0n$ ($0 < -t < 1.4$ (GeV/c)^2). Incident π^- momenta were 20.7, 40.6, 66 and 101 GeV/c, obtained at the NAL Meson Laboratory. The effective Regge ρ trajectory for these data is discussed. The relation between the new forward differential cross sections and existing data on π^-p and π^+p total cross sections is examined. (auth)

18316 (RL-74-146) SIMPLE TESTS OF QUARK-NUCLEON RECIPROCITY. Zarmi, Y. (Science Research Council, Chilton (UK). Rutherford Lab.). Oct 1974. 12p. Dep. NTIS (U. S. Sales Only) $4.00.

Simple tests of the quark-nucleon reciprocity relation are proposed. Wave function corrections for nuclear targets are not necessary. Neutrino reactions can test this relation for each type of quark individually. (auth)

18317 RELATIVISTIC EIKONAL FORMULA FOR PRODUCTION PROCESSES. Koyama, H. (Osaka Prefectural Univ., Sakai, Japan). Progr. Theor. Phys. (Kyoto); 51: No. 3, 865-876(Mar 1974).

Eikonal formulas for the production process $NN \to NN + n\pi$ are studied on the basis of a relativistic field-theoretical model in which the potential between nucleons, pion emission and absorption are all induced by a scalar field A. The functional integral method is used to derive formulas. Within the "straight path" approximation for the initial particles, it is shown that an exact impact parameter representation for production amplitude can be obtained, including all internal interactions, in particular, nucleon loops. The amplitude is properly represented with the aid of three variables; i.e., transverse vector and two longitudinal coordinates. The latter two correspond to two moving intermediate nucleons respectively. These variables compose a vector in a four-dimensional space called "eikonal frame", and a modified rapidity is introduced. Multiple scattering effects by the A field are investigated and a cluster expansion with respect to correlated A-lines is performed for eikonal phase of production amplitude. (auth)

18318 NON-DIFFRACTIVE AND DIFFRACTIVE MECHANISM IN MULTIPARTICLE PRODUCTION PROCESS. Morii, T. (Kobe Univ., Japan); Noda, H. Progr. Theor. Phys. (Kyoto); 51: No. 2, 546-560(Feb 1974).

A model for exclusive reactions is proposed in the viewpoint of a coexistence of nondiffractive and diffractive mechanism. Experimental data of partial cross sections and invariant mass distributions in π^-p collision are analyzed in this model. It is shown that in the energy region from threshold to $P_L \simeq 100$ GeV/c, a gross structure of the reaction mechanism of exclusive reaction with a fixed multiplicity, say several, is characterized by the following three regions with energy: region (I): nondiffractive mechanism dominates, region (II): nondiffractive and diffractive mechanism are comparable to each other, and region (III): diffractive mechanism dominates. These regions exhibit a band scheme on the multiplicity—the incident momentum plane. (auth)

18319 COLOR-SYMMETRY BREAKING AND THE BARYON SPECTRUM. Capps, R.H. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). Phys. Rev. Lett. 33: No. 27, 1637-1640 (30 Dec 1974).

In the colored-quark model, if the three vector gluons that correspond to an SU(2) subgroup of SU(3) are heavier than the other gluons, a quark-diquark structure for baryons results. Furthermore, the predicted baryon SU(6) representations are the $\underline{56}$ for even parity and the $\underline{70}$ for odd parity, in agreement with recent experimental indications. (auth)

18320 ($7/2^{\pm}$)-OCTETS AND ANALYSIS OF RESONANCES DECAY WIDTH. Kostyrko, I. I. (Inst. of Mathematics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 10, 1716-1719(Oct 1974). (In Russian).

A barrier potential method is applied to the analysis of resonance decay width for ($7/2^{+}$)-multiplets within SU_3-symmetry. (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstracts 18344, 18427, and 18429.

18321 (ANL/HEP-7440, pp XIV.1-XIV.18) PHENOMENOLOGY OF ELASTIC SCATTERING. Thomas, G. H. (Argonne National Lab., IL). Feb 1974.

From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).

In symposium on high-energy physics with polarized beams.

This paper is concerned with a sample phenomenological program for extracting quantities of physical interest from scattering amplitude measurements. Only simple models for the pp amplitudes are used. Since a phenomenological analysis of spin amplitudes depends to some extent on the choice of basis, this topic is treated first. Then as an example it is shown how, in a simple model, the lack of abnormal parity exchange amplitudes leads to predictions for experiments with targets polarized normal to the scattering plane. Finally, the orthogonal set of experiments using targets polarized in the scattering plane is discussed. A simple point of view shows that they provide potentially new information on diffractive amplitudes. Targets polarized in these different ways yield quite different information about the nucleon–nucleon system. (4 figures, 3 tables) (RWR)

18322 (DESY–74/53) SYNTHESIS OF THE NUCLEON–NUCLEON INTERACTION AT "LOW" AND "HIGH" ENERGIES. Schierholz, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nov 1974. 14p. (CONF-740822–11). Dep. NTIS (US Sales Only) $4.00.

From Conference on few body problems in nuclear and particle physics; Quebec, Canada (27 Aug 1974).

The review of the nucleon-nucleon interaction at low and high energies included OBE models, the short-range forces, short-distance behavior, and medium-range forces. (JFP)

18323 (HU-TFT-74-3) WHERE DO DIFFRACTIVE NUCLEONS GO. Kajantie, K.; Ruuskanen, P. V.; Sohlo, S. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Feb 1974. 26p. INIS.

Nucleon and pion-nucleon distributions from the diffractive component in pp collisions are analyzed. Diffractive events are assumed to come from a mechanism pp → N^*p, in which a proton is diffractively excited to a nova N^*. The decay properties of N^* are determined by assuming that a Pomeron–proton collision behaves as a proton-proton collision. Correlations within the diffractive component are computed and seen to be numerically small. Even interference with the pionization component does not reproduce the observed pattern of pion (in the plateau)—proton (in the fragmentation region) correlations. This may imply the existence of long-range correlations within the pionization component. (auth)

18324 (IC–73-25) TAIL OF THE SPECTATOR IN k^+D k^0pp. Alberi, G.; Gregorio, M. A.; Thome, Z. D. (International Centre for Theoretical Physics, Trieste (Italy)). 1973. 10p. INIS.

The large values of the spectator momentum distribution for large values of this variable are explained with a model based on final-state interaction of the two emerging protons. A comparison with recent experimental data is presented. (auth)

18325 (JINR–E2-8276) HAVE DISPERSION RELATIONS FOR THE FORWARD pp-, $\bar{p}$p-SCATTERING AMPLITUDE REALLY BEEN TESTED? Dumbrais, O. V.; Staszel, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

The apparent agreement between the calculated by means of dispersion relations real parts of the pp forward scattering amplitude and their experimental values seems to be a coincidence that comes from the large ambiguity due to the lack of information on the behavior of the imaginary part of the amplitude in the unphysical and low energy regions of the $\bar{p}$p scattering. The arguments are given according to which the absolute values of the measured in the medium energy range (2 to 30 GeV) real part of the forward pp scattering amplitude are strongly underestimated (by a factor of 1.5 to 2). (auth).

18326 (JINR-P2-8221) INTERACTION OF TWO NUCLEONS IN FINAL STATE IN pd → ppn REACTION. Golovin, B. M.; Lykasov, G. I.; Khamraev, F. Sh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The contribution of final state NN-interaction from single and double scattering in the reaction pd → ppn is analyzed. The results of calculations of the differential sections $d^3\sigma/d\Omega_1 d\Omega_2 dT_1$ at $T_p = 585$, 600 MeV are given and compared with experimental data. (auth)

18327 (JINR–P4-8341) NUCLEON–NUCLEON SCATTERING S-PHASES IN THE BOUNDARY CONDITION MODEL. Efimov, V. N.; Shelontsev, I. I.; Shul'ts, G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

It was shown that the off-shell t-matrix in the boundary condition model can be obtained avoiding introduction of a concrete form of two-particle potential, on the basis of boundary conditions, only, superimposed on the off-shell wave function. The method is generalized for the case of the energy-dependent parameters of the boundary condition model which can be determined in an exact correspondence with the scattering phases. (auth)

18328 STRONG–INTERACTION EFFECTS IN ANTIPROTONIC ATOMS. Deloff, A.; Law, J. (Physics Department, University of Guelph, Guelph, Ontario N1G 2W1, Canada). Phys. Rev. C 10: No. 6, 2657-2658 (Dec 1974).

A $\bar{p}$–nucleus potential is constructed by folding a $\bar{p}$N potential in the nuclear matter density. The strength of the $\bar{p}$N potential is adjusted to the corresponding scattering lengths. The resulting $\bar{p}$–nucleus force consistently reproduces the antiprotonic atoms level shifts and widths. (auth)

18329 ELASTIC SCATTERING, PRODUCTION PROCESS, AND THEIR RELATION IN HIGH ENERGY NUCLEON–NUCLEON COLLISIONS. Doi, M. (Osaka Univ., Toyonaka, Japan). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1437-1454(May 1974).

The production process $N + N \rightarrow N + N + n\pi$ is investigated on the basis of covariant field theory. The production amplitude as well as elastic one is calculated under the special assumption about production mechanism. The eikonal approximation for nucleon trajectories is introduced, so these amplitudes are expressed in an impact parameter representation. They satisfy the s-channel unitarity for the elastic process. The Feynman scaling behavior for the pion inclusive spectra is reduced as an automatic consequence of the present model. Furthermore, the difference between the transverse and longitudinal distribution of pion momenta can be explained. The imaginary part of the phase shift in an elastic channel is reduced as a reflection of the production process, and it reproduces diffractive properties for the elastic differential cross section. Comparisons with p-p scattering data are made for various physical observables, namely, inclusive spectra for pions, average multiplicity, elastic and production cross sections and elastic differential cross section. Agreement is fairly satisfactory. (auth)

18330 ANALYSES OF THE INCLUSIVE DISTRIBUTIONS $p + p \rightarrow \pi^\pm X$ AND $K^\pm X$ ON THE BASIS OF THE KUTI–WEISSKOPF QUARK–PARTON MODEL. Biyajima, M.; Miyamura, O. (Osaka Univ., Toyonaka, Japan). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1455-1472(May 1974).

The Kuti–Weisskopf (K-W) quark-parton model is applied to analyses of the hadronic inclusive distributions. This model contains valence quarks, core quarks and gluons, reflecting the two-component duality picture. In these model calculations, the following three processes are assumed to be dominant contributions: quark-anti-quark annihilation into a meson, meson-pair production from parton-parton collision, and bremsstrahlung-like process. The phenomena in the proton fragmentation region are resolved: The behavior of $(1 - x_F)^{3\sim4}$ is obtained for the nonexotic processes ($pp \rightarrow \pi^\pm X$ and K + X). A slim shape of x_F-distribution near $x_F \sim 0$ is obtained for the exotic process (pp → K – X). It is found that the π/K ratio can be reproduced by the coefficient twice as large as SU(3) symmetric one. The obtained spectra can reproduce reasonably well the observed data in the wide energy range in terms of only a few parameters. (auth)

18331 NUCLEON–NUCLEON SCATTERING PHASE SHIFTS BY THE NAMBU–SALPETER–BETHE EQUATION: $^3S_1 + {}^3D_1$ AND $^3P_2 + {}^3F_2$ WAVES. Ito, H. (Kinki Univ., Higashi, Japan); Murota, T.; Noda, M. T.; Tanaka, F. Progr. Theor. Phys. (Kyoto); 51: No. 4, 1115-1122(Apr 1974).

A numerical solution of the NSB equation (BS equation) is investigated in the two-channel states. The interaction is assumed to be the ladder exchange of pi-mesons, and pair creation effects in the intermediate states are neglected. In the $^3S_1 + {}^3D_1$ wave the channel-coupling effect is very strongly attractive and a bound state is found. It is seen that the channel-coupling effect is so large that the classification of states by the orbital angular momentum is doubtful even in an approximate sense. The effect of the iteration of the rungs is rather small in the $^3P_2 + {}^3F_2$ wave, but the channel-coupling effect is fairly large even in this wave. (auth)

18332 NEUTRON–DEUTERON SCATTERING AND DEUTERON STRUCTURE. An Improvement of the Impulse Approximation. Morioka, S. I. (Osaka Univ., Suita, Japan); Ueda, T. Progr. Theor. Phys. (Kyoto); 51: No. 4, 1103-1114 (Apr 1974).

Neutron–deuteron scattering is discussed in a new treatment of the deuteron. The deuteron is divided into two parts with respect to the two-nucleon distance. The outer part is treated as a composite particle and applies the impulse approximation. However, the inner part is regarded as an elementary particle, and a field-theoretical calculation of the one-baryon-exchange process is applied. Thus the latter treatment improves the inadequacy of the impulse approximation. Numerical results of the differential cross section in the 14 to 146 MeV region are compared with experimental data and found to be in agreement both at the forward and backward scattering angles. However, some deviation is appreciable at intermediate scattering angles ($\theta_{cm} = 50 \sim 120°$) especially below 40 MeV. (auth)

Particle Invariance Principles and Symmetries

General

18333 FORMULA FOR THE COMPUTATION OF THE REPRESENTATION MATRIX ELEMENTS OF THE GROUP *SO* (*n*). Maekawa, T. (Department of Physics, Kumamoto University, Kumamoto, Japan). J. Math. Phys. (N.Y.) 16: No. 2, 334-340 (Feb 1975).

The formulas for expressing the infinitesimal operators of the parameter groups of *SO* (*n*) in terms of the Euler angles are given. By using these, recursion relations which are useful for calculations of the representation matrix elements of *SO* (*n*) are obtained. Expressions for the *d* functions with the highest and some weights are obtained explicitly, and it is shown that the *d* functions of *SO* $(2j+1)$ or *SO* $(2j)$ with special weights agree with those of *SO* (3) or *SO* (4), respectively. By using the results, a formula for computing the *D*—matrix elements of *SO* (*n*) is given in terms of lowering operators corresponding to those of Pang and Hecht. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstracts 18290 and 18511.

18334 EXCHANGE EFFECTS AND SU_4 INVARIANCE IN ELECTROMAGNETIC AND WEAK TRANSITIONS. Cannata, F. (Univ., Bologna); Fujita, J. I. Progr. Theor. Phys. (Kyoto); 51: No. 3, 811-822(Mar 1974).

The consequences of SU_4 symmetry are studied using the hypothesis that the SU_4 algebra is generated by 15 operators: $T^{\alpha} = \int V_4^{\alpha}(x)dx$, $Y_{\kappa}^{\alpha} = \int A_{\kappa}^{\alpha}(x)dx$, $S_{\kappa} = \int A_{\kappa}^{0}(x)dx$. V and A denote the vector and axial vector hadronic currents, with the upper index referring to isospin and the lower one to Lorentz space (κ = 1, 2, and 3). Particular emphasis is given to the treatment of muon capture. The equality between the vector and axial vector matrix elements and the connection of the vector matrix elements to the photoabsorption cross section are discussed for this process. Finally some conclusions are drawn about many-body effects in electromagnetic and weak nuclear transitions from the current algebra and SU_4 invariance for the nuclear Hamiltonian. (auth)

18335 EFFECT OF T-INVARIANCE DISTURBANCE PION ELECTROPRODUCTION NEAR THRESHOLD. Omelaenko, A. S.; Gakh, G. I.; Kulish, Yu. V. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 10, 1623-1630(Oct 1974). (In Russian).

The effects of T-invariance possible disturbance in the electromagnetic interactions of hadrons are considered for the reaction $e^-N \rightarrow e^-\pi N$ at the threshold value of complete energy. The amplitude of charged pions electroproduction which preserves T-invariance was calculated in the Born approximation and in the model of the algebra of currents, the analogous amplitude of neutral pions electroproduction—in the model of the algebra of currents. Disturbance of T-invariance was introduced phenomenologically by adding a complex additive to the real amplitude (with the threshold energy). Numerical estimations are performed for the electroproduction reaction at different values of the transferred momentum square. Limitations for the value disturbing T-invariance of contributions to the amplitude are obtained from the experimental data concerning asymmetry of inelastic electron scattering by a polarized proton. (auth)

Applications (Strong)

Refer also to abstracts 18217 and 18319.

18336 (ORO-3992-189) MODEL FOR CHIRAL SU(4) ⊗ SU(4) BREAKING BASED ON THE (15,15) REPRESENTATION. Deshpande, N. G.; Dicus, D. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 22p. (CPT-233). Dep. NTIS $4.25.

The (15,15) breaking was investigated for SU(4) ⊗ SU(4) symmetry breaking as an alternative to the $(4^*,4)$ model. The form for the Hamiltonian is so chosen that pions obey the PCAC equation, and the parameters in the Hamiltonian are then determined by meson dominance. The Hamiltonian is found to be SU(3) ⊗ SU(3) invariant to a very good approximation, permitting charmed mesons to be massive and thus escape detection. Also $\pi-\pi$ scattering lengths and the decay $X \rightarrow \eta\pi\pi$ are evaluated in this model. Other choices of Hamiltonians within (15,15) breaking are also considered, but shown to be unsatisfactory. (auth)

18337 THE UNITARY IRREDUCIBLE REPRESENTATIONS OF $\overline{SL}$ (3,*R*). Šijački, D. (Department of Physics, Duke University, Durham, North Carolina 27706). J. Math. Phys. (N.Y.) 16: No. 2, 298-311 (Feb 1975).

The unitary irreducible representations of the universal covering group, $\overline{SL}$ (3,*R*), of the *SL* (3,*R*) group are analyzed by means of the methods developed by Harish—Chandra and Kihlberg. We have found a single closed expression for the matrix elements of the noncompact generators for an arbitrary unitary representation of the $\overline{SL}$ (3,*R*) group. The irreducibility of the representations is achieved by using the little group technique, and the scalar product for each irreducible Hilbert space is explicitly given. Contraction (in the Inönü and Wigner sense) of the $\overline{SL}$ (3,*R*) unitary irreducible representations to the corresponding representations of the $T_5 \circledS SU$ (2) group is discussed. (auth)

18338 CHIRAL SYMMETRY BREAKING AND MESON—NUCLEON SIGMA COMMUTATORS: A REVIEW. Reya, E. (Institut für Physik, Universität Mainz, 6500 Mainz, West Germany). Rev. Mod. Phys. 46: No. 3, 545-580 (July 1974).

Chiral symmetries are discussed in considerable detail, and their importance and consequences for the study of elementary particle physics are reviewed. For the study of broken symmetries we concentrate mainly on meson—nucleon sigma terms, $\pi\pi$ scattering, and K_{l3} decays. In addition to giving a critical and detailed review of most of the "experimental" estimates for pion—nucleon and kaon—nucleon sigma terms done so far, we also outline the most common chiral symmetry—breaking schemes at present, such as $(3,\bar{3})+(\bar{3},3)$, $(6,\bar{6})+(\bar{6},6)$, (8,8) and (1,8)+(8,1) representations of SU(3) ×SU(3) and possible mixtures of them, and discuss and compare their predictions with experiment. Nonlinear effective Lagrangians are briefly discussed, and the connection between broken scale invariance and chiral symmetry breaking is outlined, with emphasis on our present knowledge of meson—nucleon sigma terms. (auth)

Scattering Theory

Refer also to abstract 18657.

18339 (CNRS-CPT-73-P-572) SCATTERING THEORY WITH SINGULAR POTENTIALS. I. The Two-Body Problem. Robinson, D. W. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Sep 1973. 53p. Dep. NTIS (U. S. Sales Only) $5.75.

The definition of a self-adjoint Hamiltonian for a two-body system interacting with a positive singular potential is considered. For highly singular potentials a result of essential self-adjointness is obtained, for less singular potentials the equality of the Friederichs extension and the form sum extension is proved. An approximation scheme for singular potentials is then introduced and it is demonstrated that if the potentials are approximated from below by bounded potentials then the corresponding Hamiltonians converge in the strong resolvent sense. Lavine's results on scattering with positive, decreasing, H_0-relatively bounded potentials are extended to positive, decreasing potentials with an arbitrary singularity at the origin. In particular, the absolute continuity of the spectrum and strong asymptotic completeness are established. A monotonicity criteria for the application of the perturbation theory to systems with a residual repulsive interaction is developed. Results on the negative spectrum are obtained by linear bounds and weak asymptotic completeness, by quadratic bounds. These results are illustrated by a discussion of the Lenard-Jones interaction. Most of the results are valid in all but two dimensions. (auth)

18340 (ORO-3992-191) CAUSALITY IN SCATTERING. van Kampen, N. G. (Texas Univ., Austin (USA). Center for Particle Theory). [nd]. 8p. (CPT-235). Dep. NTIS $4.00.

In the first lecture the purpose is to obtain the maximum information about the S-matrix with a minimum of assumption about the interaction. The examples of a vibrating visco-elastic rod and the scattering of the electromagnetic field by a spherically symmetric fixed center are taken. The dispersion relations connecting the real and imaginary parts of Green's function are derived. It follows rigorously that S-matrix has a one-valued analytic continuation whose only singularities are poles in the lower left half plane and whose behavior at infinity can be specified. In the second lecture the S-matrix for nonrelativistic particles is considered. The causality condition is formulated as follows: At any time the total probability of finding the particle outside the scattering center shall not be greater than 1 for every form of incident wave packet. From this it follows that for spherical waves, S, as a function of the momentum p, are analytic and holomorphic in the first quadrant and that e^{2iap} S(p) (where a is the radius of the scattering center) has an imaginary part ≤ 1. That suffices to give an explicit integral representation and a product expansion for S. The properties of the Wagner R-matrix can also be deduced. (auth)

18341 QUASISECULAR SCATTERING IN THE ϕ^4 MODEL. Varga, B. B.; Aks, S. O. (Univ. of Illinois, Chicago). Phys. Rev., D; 10: No. 2, 614-621(15 Jul 1974).

The first-order renormalized Hamiltonian, calculated by the quasisecular perturbation method applied to the weakly nonlinear ϕ^4 model of quantum field theory, is used to discuss the scattering of two particles. The scattering amplitude is found by an approximation which is accurate for weak coupling. For one space dimension a resonance in the s-wave scattering occurs at threshold for both signs of the ϕ^4 coupling. For two space dimensions a resonance occurs only for the sign of coupling which also gives a bound state as found previously and the resonance lies above threshold by the bound-state energy. For three dimensions the scattering amplitude shows very little structure. Comparison of the scattering amplitudes is made with the Bethe-Salpeter equation. (auth)

18342 ON THE GENERALIZATION OF THE PHASE FUNCTION METHOD IN THE POTENTIAL SCATTERING THEORY. Babikov, V. V.; Khankhasaev, M. Kh. (Joint Inst. for Nuclear Research, Dubna (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 725-729(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

One approach to the potential scattering theory at high energy was examined. The approach was based on the generalized method of phase functions. It was shown that the given freedom in the selection of the equation for scattering amplitudes lies at the basis of the approach. One of the possible derived nonlinear integral–differential equations for the scattering amplitude was developed. It coincided without limitation to the potential symmetry. (tr-auth)

18343 TESTS OF RESONANCE RECOGNITION CRITERIA IN COUPLED CHANNEL PROBLEMS WITH SEPARABLE POTENTIALS. Gauthier, L.; Kamal, A.M. (Physics Department and Theoretical Physics Institute, University of Alberta, Edmonton, Alberta T6G 2El, Canada). Ann. Phys. (N.Y.) 88: No. 1, 193-241 (Nov 1974).

Exactly soluble two–body two–channel problems are set up with separable potentials. Resonance is defined theoretically; then the empirical resonance recognition criteria used in two–body data analyses are tested. Results are summarized in the last section of the paper. (auth)

18344 MULTIPLE SCATTERING EXPANSIONS IN SEVERAL PARTICLE DYNAMICS. Joachain, C.J. (Physique Théorique et Mathématique, Faculté des Sciences, Université Libre de Bruxelles, Brussels, Belgium); Quigg, C. Rev. Mod. Phys. 46: No. 2, 279-324 (Apr 1974).

The problem of quantum collisions involving several particle systems is reviewed within the framework of multiple scattering theory. The basic apparatus of collision theory for nonrelativistic potential problems is first developed, and the Born and eikonal series are introduced. A general analysis is then given of multiple scattering expansions for several particle problems. We discuss in particular the Born developments, the Faddeev–Watson expansions, the Glauber method, and various multiple scattering approaches to the determination of the optical potential. Applications to atomic collision problems and to high–energy hadron–deuteron scattering are discussed at length. (auth)

18345 LIMITING ANGLES OF PARTICLE DEFLECTION IN CLASSICAL SCATTERING ON A CENTRALLY SYMMETRIC POTENTIAL. Meierovich, B. E. (Inst. of Physical Problems, Moscow). Dokl. Akad. Nauk SSSR; 216: No. 2, 306-308(11 Mar 1974). (In Russian).

Classical scattering of particles on a finite centrally symmetric potential with repulsion U(r), decreasing during recession from the center, was examined. It was shown that particles with energy greater than the Maxwell value of the potential U_0 are deflected at an angle not exceeding the determined limiting value depending on the behavior of the potential near the center. (JSR)

18346 METHOD OF AVERAGING WAVEFUNCTION CORRECTIONS IN SCATTERING THEORY. Malik, D.J.; Weare, J.H. (Department of Chemistry, Revelle College, University of California, San Diego, La Jolla, California 92037). J. Chem. Phys. 62: No. 3, 1044-1057 (1 Feb 1975).

A convergent perturbative method is presented for strong interaction scattering problems. The procedure resembles the method of averaging functional corrections and can be related to a distorted-wave perturbation scheme. The method relies on the introduction of a finite linear basis set to approximately describe the wavefunction. This leads to a Lippmann–Schwinger-type integral equation with a reduced interaction strength. An iterative solution is obtained similar to the Born series. Improvement of the basis set improves the reliability of the low-order terms in the series. The convergence of the series is discussed, and convergence criteria are given. The method can also be used to determine the singularities of the *T* matrix. The wavefunctions associated with these singularities may be used to remove the divergent behavior of the iterative solution to the integral equation. To illustrate the convergence behavior we apply the method to an integral equation with a separable kernel. The method is applied to several simple examples, and the results are compared to the usual Born series. Significant improvements in accuracy are noted over the Born series as well as an extension of the region of convergence. Comparison with other similar procedures is discussed. (auth)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

Refer also to abstracts 18129 and 18392.

18347 PHONON VISCOSITY AND WIDE–ANGLE PHONON SCATTERING IN SUPERFLUID HELIUM. Benin, D. (Department of Physics, Arizona State University, Tempe, Arizona 85281). Phys. Rev. B 11: No. 1, 145-149 (1 Jan 1975).

Maris's numerical results for the viscosity of phonons with anomalous dispersion in superfluid He^4 are obtained by a simplified method which involves variational calculation of the eigenvalues of the completely continuous part of the collision integral operator in the phonon Boltzmann equation. We also obtain an analytic expression relating a sequence of wide–angle relaxation times to the phonon frequency anomaly. (auth)

18348 CHARGE–CARRIER MOBILITIES IN SUPERFLUID HELIUM UNDER PRESSURE. Brody, B. (H. M. Randall Laboratory of Physics, The University of Michigan, Ann Arbor, Michigan 48104). Phys. Rev. B 11: No. 1, 170-177 (1 Jan 1975).

Data are presented for the mobilities of the positive and negative charge carriers, and the ratios of these, in superfluid helium, from 1.2 K through the λ line and from the vapor pressure to the freezing curve. (auth)

18349 SPIN DIFFUSION AND SPIN ECHOES IN SUPERFLUID ^{3}He. Combescot, R. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853). Phys. Rev. Lett. 34: No. 1, 8-11 (6 Jan 1975).

The spin–diffusion coefficient for spin–echo experiments is calculated in the A phase and in the B phase of superfluid ^{3}He, using a relaxation–time approximation. Spin–wave attenuation is discussed for long wavelengths. It is pointed out that Leggett's result for the NMR lineshift is true over the complete range of frequency. (auth)

18350 HETEROGENEOUS SURFACES AND SUPERFLUID ONSET. Cole, M.W.; Dash, J.G.; Herb, J.A. (Physics Department, University of Washington, Seattle, Washington 98195). Phys. Rev. B 11: No. 1, 163-169 (1 Jan 1975).

Nonuniformity of substrate properties can be detected in the physical adsorption of common molecular gases including helium. Effects due to binding–energy variation extend beyond the first adsorbed layer, usually to thicknesses of many layers. We qualitatively describe reasons for this persistence and show how its form and range are related to the spatial variation of the binding energy. Heterogeneity can play an important role in the appearance of superfluidity in thin films of He^4. It is argued that heterogeneity has been a more serious perturbation in superfluid–onset experiments than is generally recognized; that heterogeneity can account for the lack of agreement between experiments which use different techniques and/or substrates; that the experimental disagreements have hindered development of a satisfactory theory of superfluidity in thin films. We derive a thermodynamic formula relating the shifts of onset temperature with thickness to the lateral scale of the thickness variations caused by substrate heterogeneity, and illustrate its application in simple examples. The sensitivity of superfluid onset to heterogeneity might be exploited for surface characterization, yielding important information that is not presently obtainable by other methods. As a separate benefit, it can lead to a clearer understanding of superfluidity. Specific experimental tests are suggested. (auth)

18351 SPIN–FLUCTUATION STABILIZATION OF ANISOTROPIC SUPERFLUID STATES. Brinkman, W.F. (Bell Telephone Laboratories, Holmdel, New Jersey 07733); Serene, J.W.; Anderson, P.W. Phys. Rev. A 10: No. 6, 2386-2394 (Dec 1974).

The role spin fluctuations play in determining the stable superfluid phases of He^3 is investigated. It is shown that the feedback effects of the gap on the spin fluctuations can stabilize the anisotropic Anderson–Morel (AM) state if they are sufficiently strong. The effect is calculated both near T_c and at zero temperature. It is found that the Balian–Werthamer (BW) state is more stable at low temperatures and that the slope of the calculated transition from the AM to BW states qualitatively agrees with the experimental slope of the A to B transition as a function of pressure. (auth)

18352 QUANTITATIVE STUDY OF THE ZAWADOWSKI–RUVALDS–SOLANA MODEL OF THE DYNAMICS OF LIQUID HELIUM. Hastings, R.; Halley, J.W. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). Phys. Rev. A 10: No. 6, 2488-2500 (Dec 1974).

We study the Zawadowski–Ruvalds–Solana (ZRS) model of quasiparticle interactions in liquid helium both quantitatively and theoretically. We find that the model cannot account quantitatively for the multiphonon peak in the neutron–scattering spectrum even if we vary the quasiparticle spectrum phenomenologically. We find that the model can account for the experimental light–scattering spectrum if the effective roton–roton coupling $g_4(\vec{k}, \vec{k}')$ is sharply peaked at the roton minimum ($k \simeq k' \simeq k_0$). We suggest that the neutron–scattering results would be improved without changing the light–scattering prediction if the density operator contained nonlinear terms in the quasiparticle operator. We criticize the implicit assumption in the ZRS model that the zero–order ground state is nondegenerate. The relationship of the ZRS model to one devised by Jackson is discussed. (auth)

18353 THREE–PARTICLE CORRELATIONS IN THE GROUND STATE OF A BOSE FLUID. Berdahl, P. (Physics Department, University of Washington, Seattle, Washington 98195). Phys. Rev. A 10: No. 6, 2378-2385 (Dec 1974).

The two– and three–particle distribution functions of the weakly interacting Bose gas in its ground state are studied via the calculation of their Fourier transforms. The form obtained for the three–particle distribution function shows that the familiar convolution approximation is not correct even in lowest, nontrivial order of perturbation theory. For the special case of the charged Bose gas at high density, the two–particle distribution function is obtained to second order in the expansion parameter $r_s^{3/4}$, a result which disagrees with a recent calculation. The discrepancy is traced to a use of the convolution approximation for the three–particle distribution function. Finally, Landau's theory of quantum hydrodynamics is employed to relate the long–range part of the three–particle distribution function to the Grüneisen constant. These results emphasize the need to treat properly the dynamic three–particle correlations in any quantitative theory of liquid helium. (auth)

18354 SPHERICAL PROBES AND QUANTIZED VORTICES: HYDRODYNAMIC FORMALISM AND SIMPLE APPLICATIONS. Schwarz, K.W. (Department of Physics and The James Franck Institute, The University of Chicago, Chicago, Illinois 60637). Phys. Rev. A 10: No. 6, 2306-2317 (Dec 1974).

The velocity field of an ideal fluid in the presence of a moving spherical boundary and a vortex line of arbitrary configuration is found, and the hydrodynamic force acting on the sphere determined. Using this formalism, one may compute the motion of the sphere and the vortex line in the general case where the sphere has inertia and is subject to externally applied forces. The resulting algorithm can be utilized to study the complicated hydrodynamic interactions between charge carriers and quantized vortices in superfluid helium. As simple examples of the application of the hydrodynamic formalism, the force exerted on a moving sphere by an instantaneously rectilinear vortex is evaluated, and the interaction of a vortex ring with a fixed sphere is considered. (auth)

18355 TRANSVERSE NMR MEASUREMENTS ON SUPERFLUID ^{3}He. Ahonen, A.I.; Haikala, M.T.; Krusius, M.; Lounasmaa, O.V. (Low Temperature Laboratory, Helsinki University of Technology, SF–02150 Otaniemi, Finland). Phys. Rev. Lett. 33: No. 27, 1595-1598 (30 Dec 1974).

Transverse NMR measurements on liquid ^{3}He are reported down to 0.7 mK at several pressures below 27 bar. In the A liquid the quadratic NMR frequency shift is proportional to $T_c^2(1-T/T_c)$. In the B phase the integrated dynamic susceptibility falls to a limiting value which is 25% of the Fermi–liquid susceptibility. NMR data on the A and B liquids confined in the voids of fine powder are also presented. (auth)

Superconductivity

Refer also to abstracts 16392, 17006, 17040–17044, 17046–17048, 17055, 17097, 17115, 17198, 17201–17203, 17207, 17209, 17216, 17229, 17230, 17232–17333, 17352, 17363, 17364, 17366, 17371, 17373–17376, 17400, 17401, 17403, 17406, 17409, 17437, 17447–17449, 17463, 17465, 17482, 17484, 17514–17519, 17545, 17559, 17560, and 17564.

18356 SURVEY OF SUPERCONDUCTING MATERIALS. Hulm, J. K.; Blaugher, R. D. (Westinghouse Research Labs., Pittsburgh). pp 3-13 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833–(P3).

An overview of superconducting materials is presented for the nonspecialist. Attention is focussed on the β-tungsten or A 15 group of superconductors. (MHR)

18357 FLUCTUATIONS IN SUPERCONDUCTORS. Tinkham, M. (Harvard Univ., Cambridge, MA). pp 14-26 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

How thermodynamics fluctuations affect the observable properties of superconductors, both above and below T_c, is discussed. Attention is restricted here to the basic hallmarks of superconductivity, perfect conductivity and perfect diamagnetism. An outline is presented of how the idealized properties of superconductors without fluctuations can be understood within the conceptual framework of the Ginzburg-Landau theory. Consideration is given to how fluctuations modify the idealized sharp transitions. (MHR)

18358 SUPERCONDUCTIVITY AT HIGH PRESSURES. Olsen, J. L. (Eidgenoessiche Technische Hochschule, Zurich). pp 27-33 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The effect of pressure on the following properties of a superconductor is reviewed briefly: transition temperature, critical magnetic field and Ginzburg–Landau parameter. (MHR)

18359 STRUCTURE OF A VORTEX IN A DIRTY SUPERCONDUCTOR. Watt-Tobin, R. J.; Waterworth, G. M. (Univ. of Lancaster, Eng.). pp 37-41 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

In the dirty limit Eilenberger's Green's functions became nearly isotropic, and Usadel has derived a much simpler diffusion equation determining the "normal" function and "anomalous" function in this approximation. Calculating the structure of a vortex falls into three parts: solving the self-consistency problem, computing the tunneling density of states, and calculation of thermodynamic functions. (MHR)

18360 OBSERVATION OF LANDAU-TYPE BRANCHING IN THE INTERMEDIATE STATE. Allen, J. F.; Lerski, R. A. (Univ. of St. Andrews, Scotland). pp 42-45 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A Bitter pattern technique was used to investigate the magnetic structures on the surface of a 2 cm by 2 cm superconducting cylinder placed in an axial field. Cobalt powder of 1 μm size was blown into the cryostat and allowed to settle where it would on the sample while it was immersed in liquid helium and while the correct reduced field H/H_c was applied. Upon warming the apparatus to room temperature the pattern obtained could be replicated using cellulose tape, and examined at leisure. Patterns clearly exhibiting branching were obtained with cylinders of indium and tin for a range of reduced fields and temperature. The patterns are from the cylinder surface parallel to the cylindrical axis and magnetic field direction. (MHR)

18361 ATTRACTIVE INTERACTION BETWEEN VORTICES IN TYPE II SUPERCONDUCTORS AT ARBITRARY TEMPERATURES. Leung, M. C.; Jacobs, A. E. (Univ. of Toronto). pp 46-48 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The interaction energy in the Neumann–Tewordt theory can, as in the Ginzburg–Landau theory, be written as the sum of two terms, a positive term which decays approximately as $\exp(-2r/\Lambda)$, and a negative term which decays approximately as $\exp(-2r/\Xi$, where Λ and Ξ are the decay lengths of the vector potential and the order parameter, respectively. The asymptotic behavior of the vector potential and the order parameter was investigated using Eilenberger's formulation of the Gor'kov equations, and exact expressions were obtained for these quantities as Fourier transforms involving the nonlinear terms. An analysis of the analytic structure of these expressions is given. (MHR)

18362 CALCULATION OF THE VORTEX STRUCTURE AT ALL TEMPERATURES. Kramer, L.; Pesch, W. (Kernforschungsanlage, Juelich, Ger.). pp 49-53 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Numerical methods were developed for the computation of self-consistent solutions of the Gor'kov equations with the simplifications introduced by Eilenberger. Singly quantized vortex solutions were obtained for clean superconductors at various κ values between $1/\sqrt{2}$ and 2 and temperatures between T_c and about 0.25 T_c. The boundary conditions used are appropriate for a circular Wigner-Seitz cell. (MHR)

18363 MAGNETIC FIELD DISTRIBUTION IN TYPE II SUPERCONDUCTORS BY NEUTRON DIFFRACTION. Schelten, J.; Ullmaier, H.; Lippmann, G.; Schmatz, W. (Kernforschungsanlage, Juelich, Ger.). pp 54-63 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

It is shown that small-angle scattering of subthermal neutrons reveals the magnetic structure via the experimentally determined form factors. The form factors were determined from integral reflectivities of flux line Bragg reflections of different order. Various types of flux line lattices were investigated, ranging from a polycrystalline state up to single crystals of less than 30′ mosaic spread. The growth of different types of flux line lattices depends mainly on the crystalline state and purity of the superconducting metal. For type II/1 superconductors ($\kappa \simeq 1$) experimental results and theoretical considerations suggest an attraction between flux lines. This assumption was verified by these measurements. (MHR)

18364 NEUTRON DIFFRACTION TEST OF TYPE II THEORIES IN RELATION TO TEMPERATURE. Kahn, R.; Thorel, P. (CEN de Saclay, Gif-sur-Yvette, France). pp 64-68 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The existence of a monocrystal of vortices in a monocrystalline niobium sample was reported previously. Here this property is used to map the field around each vortex core by Fourier transformation of the Bragg peak integrated intensity. The sample is a niobium monocrystal (7 × 25 × 9) with a resistivity ratio of 80. The measurements were performed at 8, 4.2, and 1.5°K. (MHR)

18365 NUCLEAR SPIN–SPIN RELAXATION IN SUPERCONDUCTING MIXED-STATE VANADIUM. Genack, A. Z.; Redfield, A. G. (Columbia Univ., New York). pp 69-72 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The rate of dipole-dipole energy relaxation in the mixed state of vanadium was measured and anomalously rapid relaxation found. Time constants of the order of 10 msec are observed. Dipole energy relaxation in the mixed state is studied by converting the ordering of the spins in an externally applied field, larger than He$_2$, to an integral order in which there is a high degree of alignments of the spin in the local dipole field produced by their neighbors. Data taken at 1.65°K at an applied field of 805G is shown. (MHR)

18366 NATURE OF FLUX TRANSPORT NOISE. Heiden, C. (Univ., Muenster, Ger.). pp 75-78 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

An experimental setup for studying vortex motion is superconducting foils is shown schematically. A setup was used which allowed the rotation of the contact pair. The dc flux transport properties of a niobium foil are plotted. Normalized power spectra are compared for different current densities. Differential flux flow resistivity and total noise power are shown as a function of dc current density. (MHR)

18367 FLUX KINETICS ASSOCIATED WITH FLUX JUMPS IN TYPE II SUPERCONDUCTORS. Harrison, R. B.; Wertheimer, M. R.; Wright, L. S. (Royal Military Coll. of Canada, Kingston, Ont.). pp 79-81 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

By using the magneto-optic technique combined with a high-speed cine-camera, the kinetics of flux jumps in type II superconducting materials were studied. The time evolution of a typical flux jump in a cold-rolled disk of Nb–25% Zr is shown. The distance of advance of the flux front from the point of origin of the jump, is shown plotted as a function of time for the sample. The correspondence between the curve of a best-fit function and the data strongly suggests that the kinetics of flux motion during "runaway instabilities" in the present experimental situation can be explained quite accurately in terms of viscous damping. (MHR)

18368 VORTEX TRANSPORT INTERFERENCE TRANSITIONS. Fiory, A. T. (Bell Telephone Labs., Inc., Murray Hill, NJ). pp 86-89 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Interference transitions were observed previously in the mixed state of a superconducting oxygen-doped, aluminum film when flux flow was driven by applied collinear rf and dc electric transport currents. In this study particular attention is paid to the rf resistivity ρ' for rf current amplitudes small compared to the dc current. Under these conditions ρ' is independent of the rf current, and as a function of the dc electric field exhibits a series of step-like transitions which are shown. (MHR)

18369 ALTERNATING CURRENT INVESTIGATION OF PINNING SITES. Lowell, J. (UMIST, Manchester, Eng.). pp 90-94 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

It is shown how measurements of the voltage associated with an alternating current yield additional information which can test the validity of the assumptions and enable the maximum force F_m to be determined. The method is based on the observation that a sufficiently small displacement of the flux line lattice is reversible in the sense that there is no frictional dissipation from the pinning sites. Experimental observations of the in-phase and in-quadrature voltage drop associated with an alternating current in a $Pb_{35}In_{65}$ sample are shown. (MHR)

18370 MODEL FOR FLUX PINNING IN SUPERCONDUCTORS. Clem, J. R. (Ames Lab., IA). pp 102-106 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

In order to describe some of the important aspects of the interaction of fluxoids with surfaces and large defects in type II superconductors, an idealized flux-pinning model is considered which treats bulk pinning as arising from a sequence of surface pinning events. In developing this model, first surface pinning is discussed in some detail. Then, the model is introduced, an expression for the critical current density is derived, and, finally, some of its implications are discussed. (MHR)

18371 FLUX FLOW OF PURE AND DIRTY SUPERCONDUCTORS. Muto, Y.; Shinzawa, S.; Kobayashi, N.; Noto, K. (Tohoku Univ., Sendai). pp 107-111 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Transport properties in the flux-flow regime such as flux-flow resistance, the Hall effect, and the Ettingshausen effect are interesting because they give valuable information on the dynamic behavior of the superconducting order parameter. A study of the flux-flow resistance of pure V and the NbTa alloy system is described. (MHR)

18372 DYNAMIC STRUCTURE OF VORTICES IN SUPERCONDUCTORS: THREE-DIMENSIONAL FEATURES. Thompson, R. S.; Hu, C. R. (Univ. of Southern California, Los Angeles). pp 163-167 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Previously, the motion of vortices was studied using the complete set of time-dependent Ginzburg–Landau equations appropriate for a superconductor containing a high concentration of paramagnetic impurities. In order to obtain a two-dimensional solution, the boundaries at the sample surfaces and the magnetic field generated by the average transport current j_t. were ignored. Here, the three-dimensional solution of the moving vortices is completed. (MHR)

18373 NASCENT VORTEX STATE OF TYPE II SUPERCONDUCTORS. Walton, B. L.; Rosenblum, B. (Univ. of California, Santa Cruz). pp 172-176 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Recent surface impedance experiments lead to the proposal of a model for an initial, metastable step of the nucleation (and denucleation) process in type-II superconductors in the mixed state. First this model is described and then evidence is given in its support. (MHR)

18374 HALL EFFECT IN TYPE II SUPERCONDUCTORS. Ebisawa, H. (Tohoku Univ., Sendai). pp 177-180 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

According to experiments the curves of the Hall angle θ vs applied magnetic field H show sudden increases as H is lowered through H_{c2} in dirty samples, while they change only slightly in pure samples. Here, an explanation of this behavior of θ is proposed. Summaries of the microscopic calculations of θ due to the flux flow near H_{c2} are given in both the dirty and the pure limits in the framework of an effective mass approximation. (MHR)

18375 DYNAMICS OF THE DESTRUCTION OF TYPE I SUPERCONDUCTIVITY BY A CURRENT. Wiederick, H. D.; Baird, D. C.; Mukherjee, B. K. (Royal Military Coll., Kingston, Ont.). pp 207-211 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp.

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

When superconductivity in a type-I wire is destroyed by a current i greater than the critical current i_c the wire enters in to an intermediate state whose structure, and consequently the resistance of the wire, is a function of the reduced current $p = (i - i_c)/i_c$. Experimental values of the transition time τ have been obtained previously, but are not in good agreement with theoretical expressions for $\tau(p)$ which have been derived, particularly for small p values. In an attempt to resolve this discrepancy, τ was measured as a function of p and the reduced temperature T/Tc for two indium specimens. Some of the results are presented here and, since agreement between theory and experiment is still not good, possible inadequacies in the theoretical treatments are suggested. (MHR)

18376 INFLUENCE OF THERMAL EFFECTS ON THE KINETICS OF THE DESTRUCTION OF SUPERCONDUCTIVITY BY A CURRENT. Posada, E.; Robin, D.; Rinderer, L. (Univ., Lausanne, Switzerland). pp 212-216 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The kinetics of the isothermal destruction of type-I superconductivity by a current have been studied theoretically. Previously reported experiments, based on the measurement of the voltage along the sample, show fairly good agreement with this theory if the applied current J is sufficiently larger than the critical $J_c(T_0)$, where T_0 is the helium bath temperature. Close to J_c, however, the measured transition times are much longer than the theoretical ones. An explanation of this discrepancy which takes into account thermal effects is presented here. In addition, the longitudinal propagation observed in impure specimens for currents less than $J_c(T_0)$ which also has a thermal origin is discussed. (MHR)

18377 EFFECT OF AN AXIAL MOMENT ON NORMAL-PHASE PROPAGATION IN TYPE II SUPERCONDUCTORS CARRYING A CURRENT. Bussiere, J. F.; LeBlanc, M. A. R. (Univ. of Ottawa). pp 221-226 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Situations are considered where the steady conduction current is the only source of energy. The present investigation was undertaken to determine the effect of an axial magnetic moment on the velocity of propagation of a normal front. In this situation persistent currents are flowing azimuthally around the wire and effects arising from the collapse of these currents are expected. Measurements were performed on a bare wire of pure vanadium, first without a magnetic moment as a function of the current density J and applied magnetic field H. The velocity was then measured as a function of magnetic moment ($4\pi M$) for several fixed current levels and external fields. (MHR)

18378 RESPONSE OF MAGNETICALLY IRREVERSIBLE TYPE II CYLINDERS TO CURRENTS AND FIELDS APPLIED IN A PARALLEL AXIAL GEOMETRY. Walmsley, D. G.; Timms, W. E. (New Univ. of Ulster, Coleraine, Northern Ireland). pp 227-231 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The response of a fairly reversible alloy, Pb–50 In, to currents and fields applied in a parallel axial geometry is investigated, but the emphasis is on features arising from its nonreversible behavior. (MHR)

18379 LIMITED FLUX JUMPS IN HARD SUPERCONDUCTORS. Boyer, L.; Fournet, G.; Maillfert, A.; Noel, J. L. (Paris Univ., Fontenay-aux-Roses, France). pp 232-237 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

In order to verify the Swartz and Bean adiabatic critical state model, their calculation is first extended to the case where the critical current density law can be written either $j(B,T) = g(B)h(T)$ (for H_{fj} calculations), these laws having the advantage of describing the properties of the specimen rather well. A method is described for obtaining the induction profile immediately following an adiabatic flux jump. Experiments were performed on a Nb–40% Ti (mass percent) cylinder, 0.7 cm in diameter and 7 cm in length, either in liquid He for temperatures below 4.2°K or in low-pressure gaseous helium for temperatures above 4.2°K; in the latter case, in order to provide good thermal insulation, the sample was suspended by linen threads. The results reported in this paper show that the adiabatic critical state model, assuming $D_m \gg D_{th}$, gives only a qualitative agreement with the experimental results. The largest discrepancies are observed for small flux jumps and particularly for the sample in good thermal contact with the surrounding medium. (MHR)

18380 EFFECTS OF HELICAL FLOW ON I_c IN CYLINDERS OF TYPE II SUPERCONDUCTORS IN AXIAL MAGNETIC FIELDS. Gauthier, R. (Univ. of Ottawa); LaBlanc, M. A. R.; Belanger, B. C. pp 241-246 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

It has been shown previously that the current-carrying capacity of wires of type-II superconductors immersed in an axial magnetic field H II initially grows as the field increases, reaching a maximum when H II lies in the range (0.3 to 0.7) H_{c2}. Two complementary explanations proposed for this phenomenon are described. Here the dependence of I_c on the helical configuration is investigated and it is shown that this feature, together with the resonance behavior of the pinning force, correctly account for observed I_c vs H II curves. (MHR)

18381 THERMODYNAMIC PROPERTIES OF JOSEPHSON JUNCTION WITH A NORMAL METAL BARRIER. Ishii, C. (Tokyo Univ.). pp 259-263 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The results of a detailed analysis of the electronic density of states and thermodynamic potential of this current-carrying state are reported here, with special emphasis on their dependence on the phase difference ϕ. (MHR)

18382 EVIDENCE FOR THE EXISTENCE OF THE JOSEPHSON QUASIPARTICLE-PAIR INTERFERENCE CURRENT. Pedersen, N. F. (Technical Univ. of Denmark, Lyngby); Finnegan, T. F.; Langenberg, D. N. pp 268-271 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Josephson predicted that the total current density j for an oxide tunnel junction will depend on the phase difference ϕ between the two superconductors forming the junction and has the form $j = j_1 \sin\phi + [\sigma_0(V) + \sigma_1(V) \cos\phi]V$. The first term is the usual Josephson supercurrent, the second is the usual quasiparticle current, and the third is a phase-dependent current which arises from interference effects between quasiparticles and pairs at finite voltages. Here, it is shown experimentally that this term indeed does exist, that it has the expected order of magnitude, and that $\sigma_1(V)$ is actually negative. (MHR)

18383 TEMPERATURE DEPENDENCE OF THE RIEDEL SINGULARITY. Buckner, S. A.; Langenberg, D. N. (Univ. of Pennsylvania, Philadelphia). pp 285-288 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

In order to study the temperature of the broadening parameters obtained from the Riedel singularity and dI/dV data, the measurements were extended to the cases $n = 2$ to 8 with $\nu = 70$ or 140 GHz. The resulting data, covering the temperature range $0.45 \leq T/Tc \leq 0.92$, are shown. It is thought that these data reflect the combined effects of quasiparticle damping and gap anisotropy. (MHR)

18384 TUNNELING MEASUREMENT OF MAGNETIC SCATTERING. Zavaritskii, N. V.; Grigor'ev, V. N. (Inst. for Physical Problems, Moscow). pp 297-300 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Changes in the properties of the superconducting state due to magnetic scattering near the scattering center were studied. The influence of magnetic impurities on the tunnel current in the system $Al/Al_2O_3/M/S$ was investigated, where M is the magnetic impurity (iron, chromium, nickel) and S is a superconductor film (tin with thickness 3000 A). The experiments show that tunneling measurements give not only the electron scattering radius but also some information about the magnetic interaction between impurities. (MHR)

18385 JOSEPHSON WEAK LINKS: TWO MODELS. Hansma, P. K.; Rochlin, G. I. (Univ. of California, Berkeley). pp 301-305 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Two models of a Josephson weak link were investigated. For the case of low device inductance and a constant-current source both models indicate that the theory of McCumber and Stewart provides a complete description of weak-link behavior. The circuit discussed here can be used to predict the ac and dc response of the device with the difficult parameter to measure, the device capacitance, determined by a fit of α vs β_c. (MHR)

18386 ANOMALOUS TUNNELING CHARACTERISTICS. Frommer, M. H. (Massachusetts Inst. of Tech., Cambridge); MacVicar, M. L. A.; Rose, R. M. pp 306-311 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Quasiparticle tunneling into superconducting transition metals often shows current-voltage characteristics differing from the ideal curves: an excess current peak or "knee" occurring at biases near the sum of the half-energy gaps of the two superconducting electrodes. Here, evidence is given that this knee is probably caused by excess adsorbed oxygen in the oxide insulating barrier. Using bulk niobium single crystals, a knee was also observed in the I–V characteristic, although of much smaller size than previously reported. Supporting the oxygen conclusion are the correlation with the zero-bias anomaly and the existence of a physical model from which all of the observed physical behavior follows. (MHR)

18387 TUNNELING AND JOSEPHSON EXPERIMENTS IN NORMAL-SUPERCONDUCTOR SANDWICHES. Gilabert, A. (Faculte des Sciences Parc Valrose, Nice); Romagnan, J. P.; Guyon, E. pp 312-315 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A description is given of the electronic density of states and of the pair amplitude of a N/S sandwich as seen from single-particle and pair-tunneling experiments performed on the N side. Here S is a superconductor of transition temperature T_{cS} and energy gap Ω_S and N is a normal metal or a superconductor above and below its transition temperature T_{cN} ($T_{cN} < T_{cS}$). Pb was used for the superconductor and Sn or Cu for the normal metal. (MHR)

18388 HIGH-FIELD BEHAVIOR OF THE DENSITY OF STATES OF SUPERCONDUCTORS WITH MAGNETIC IMPURITIES. Bruno, R.; Schwartz, B. B. (Massachusetts Inst. of Tech., Cambridge). pp 354-358 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The densities of states of the spin-up and spin-down electrons of a thin film with spin-orbit and spin-flip (magnetic) impurities in the presence of a magnetic field are calculated. The calculations predict spectacular changes in the density of states and energy gap as a function of spin-flip parameter and magnetic field. (MHR)

18389 STRONG COUPLING SUPERCONDUCTIVITY. Carbotte, J. P. (McMaster Univ., Hamilton, Ont.). pp 587-598 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Theoretical results are presented for select thermodynamic properties of several strong coupling superconductors. The results are based on numerical solutions of the finite-temperature Eliashberg gap equations with realistic kernels taken from low-temperature tunneling data. Some comments are included on calculations of these kernels from neutron data. (MHR)

18390 THERMOELECTROSTATIC EFFECTS IN SUPERCONDUCTORS. de Waele, A. T. A. M.; de Bruyn Ouboter, R.; Pipes, P. B. (Kamerlingh Onnes Lab., Leiden). pp 772-776 of Low Temperature Physics: LT 13. Vol 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

The striking phenomena in a superconductor all have analogs in helium II. This analogy appears to be due to the fact that in both a macroscopic number of quasiparticles occupy one single quasiparticle wave function. Here, an attempt is made to find an analog in superconductors for the fountain effect in helium II. It is concluded that electrostatic voltage differences in superconductors due to a temperature gradient were observed, although in a superconductor the Thompson, Seebeck, and Peltier coefficients are zero. (MHR)

18391 STRUCTURE OF SUPERCONDUCTORS WITH DILUTE MAGNETIC IMPURITIES. Kuemmel, R. (Univ. del Valle, Cali, Colombia). pp 777-780 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

A superconductor with magnetic impurities so dilute that they can be regarded as being completely isolated is considered. Then it is sufficient to discuss a system with one impurity at the origin. The Hamiltonian of this system is diagonalized by defining new wave field operators for particles with a new quantum number from the ordinary electron field operators. The Bogolyubov equations which correspond to the diagonalized Hamiltonian are solved. (MHR)

18392 BOSE CONDENSATION IN SUPERCONDUCTORS AND LIQUID ^{4}He. Girardeau, M. D.; Yoon, S. Y. (Univ. of Oregon, Eugene). pp 781-784 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

As a test of the general formalism, the problem of interpretation and evaluation of the momentum distribution of Cooper pairs in a BCS superconductor was investigated. It is shown that the composite structure of the Cooper pair and related electron exchange effects lead to depletion of the condensate and a distribution of total momenta of Cooper pairs, but that some condensate remains. (MHR)

18393 ENHANCED PLASTICITY IN THE SUPERCONDUCTING STATE. Kostorz, G. (Institut Laue-Langevin, Grenoble, France). pp 785-789 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Measurements of the flow stress change $\Delta\tau_{SN}$ of lead single crystals deformed at 4.2°K are reported and discussed on the basis of Granato's model. (MHR)

18394 RELATION BETWEEN SUPERCONDUCTING ENERGY GAPS AND CRITICAL MAGNETIC FIELDS. Gubser, D. U.; Hein, R. A. (Naval Research Lab., Washington, DC). pp 790-793 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Here, a relation is derived between $(dh/dt)_{t=1}$ and Δ/kT_0 based on the BCS theory. There are two basic concepts involved. The first is the distinction between BCS theory and weak coupling BCS theory. The second is that $(dh/dt)_{t=1}$ is a thermodynamic quantity whose value depends on a thermodynamic average over all available states. (MHR)

18395 THEORY OF SUPERCONDUCTORS WITH SPATIALLY VARYING ORDER PARAMETER. Kuemmel, R. (Univ. del Valle, Cali, Colombia). pp 794-797 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Here it is shown that a unified treatment of the principal cases of spatially varying superconductivity at any temperature below T_c is possible by means of the WKBJ method of Bardeen et al. as far as such fundamental aspects of superconducting systems as the energy spectrum, the spatial variation of the pair potential, and the effect of magnetic fields and impurities are concerned. (MHR)

18396 ELECTRIC POTENTIAL NEAR A SUPERCONDUCTING BOUNDARY. Yu, M. L.; Mercereau, J. E. (California Inst. of Tech., Pasadena). pp 799-803 of Low Temperature Physics: LT 13. Vol. 3. Timmerhaus, K. D. (ed.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P3).

Evidence is reported for a possible extension of the two-chemical potential concept in a nonequilibrium region to a strong superconductor–weak superconductor (S/W) boundary but with the weak superconductor W driven into a dynamically normal state by a current larger than its critical current. An experiment was performed with normal and superconducting voltage probes located on the strong superconducting (S) wide of the S/W interface. One curve shows the resistive transition of the W region at critical current I_{cW} and that of the S region at critical current I_{cS}. Another curve indicates that a voltage in the reversed direction, with respect to the Ohmic behavior, appeared across the normal-superconducting leads, as in case of the S/N interface. (MHR)

18397 VARIATION OF T_c WITH ELECTRON–PER–ATOM RATIO IN SUPERCONDUCTING TRANSITION METALS AND THEIR ALLOYS. Gomersall, I.R.; Gyorffy, B.L. (H. H. Wills Physics Laboratory, Royal Fort, Bristol BS8 1TL, United Kingdom). Phys. Rev. Lett. 33: No. 21, 1286-1290 (18 Nov 1974).

A microscopic explanation is given for the variation of the superconducting transition temperature T_c with the electron–per–atom ratio in transition metals and their alloys. (auth)

18398 MAGNETIC FLUX STRUCTURES IN SUPERCONDUCTORS—A CONFERENCE SUMMARY. Huebener, R.P. (Argonne National Laboratory, Argonne, Illinois 60439); Clem, J.R. Rev. Mod. Phys. 46: No. 2, 409-422 (Apr 1974).

The proceedings of the International Conference on Magnetic Structures in Superconductors held at Argonne National Laboratory, Argonne, Illinois on 5–8 September 1973 are reviewed and summarized. Recent experimental and theoretical developments in the field of magnetic flux structures in both type–I and type–II superconductors are described, current research directions are discussed, and expected future developments are outlined. (auth)

18399 STATISTICAL MECHANICS OF GINZBURG–LANDAU FIELDS FOR WEAKLY COUPLED CHAINS. Stoeckly, B.; Scalapino, D.J. (Department of Physics, University of California, Santa Barbara, California 93106). Phys. Rev. B 11: No. 1, 205-210 (1 Jan 1975).

The free energy of a Ginzburg–Landau field describing a system of weakly coupled chains in a plane is identified with the ground–state energy of a linear array of quantum–mechanical anharmonic oscillators. The equivalent Hamiltonian is simplified for both real and complex fields using a truncated basis of states of the uncoupled oscillators. For the real field, the reduced Hamiltonian is solved, and the system is shown to have a logarithmic divergence in the specific heat similar to the anisotropic, two–dimensional Ising model. (auth)

18400 ANOMALOUS SPIN–FLIP LIFETIME NEAR THE HEISENBERG–FERROMAGNET CRITICAL POINT. Entin–Wohlman, O.; Deutscher, G.; Orbach, R. (Department of Physics and Astronomy, Tel–Aviv University, Ramat–Aviv, Tel–Aviv, Israel). Phys. Rev. B 11: No. 1, 219-223 (1 Jan 1975).

The inverse lifetime, $1/\tau_s$, of spin–flip processes for the conduction electrons in a Heisenberg ferromagnet is calculated in the first Born approximation. It is found that the temperature derivative of $1/\tau_s$ varies as $|T - T_c|^{2\nu-\gamma-1}$ and is negative above T_c and positive below T_c. Comparison is made with the behavior of the electrical resistivity near T_c. The impact upon the superconducting transition temperature is examined. (auth)

18401 SIMPLE EXPRESSION FOR THE LINEAR BOSON TRANSFORMATION COEFFICIENTS. II. Rashid, M.A. (International Centre for Theoretical Physics, Trieste, Italy). J. Math. Phys. (N.Y.) 16: No. 2, 378-380 (Feb 1975).

We obtain a simple expression for the coefficients which connect a Fock state containing an arbitrary number of quasiparticles with its transformed state under a boson Bogolubov transformation. (auth)

PHYSICS (NUCLEAR)

Neutron Interactions with Matter

Refer also to abstract 18669.

18402 (CEA-N-1710) C_N METHOD FOR SOLVING THE TRANSPORT EQUATION. Kavenoky, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Reacteurs et de Mathematiques Appliquees). Mar 1974. 361p. (In French). Dep. NTIS (US Sales Only) $21.25.

Thesis. Submitted to Paris Univ., Orsay (France).

The C_N method of solving the transport equation is based on a lemma proved by Placzek which affirms the equivalence between one transport problem in finite geometry and another in infinite geometry. In the second problem a boundary source is added; it is determined through an integral equation, the kernel of which is the Green's function for an infinite medium. This equation is the third form of the transport equation. The solution of this integral equation furnishes the angular flux at the boundaries of the media and, if needed, the flux at any point. The approximation obtained by truncation of the expansion at the order N is named C_N and its variational sense is shown. The C_N method is applied to one-velocity, linearly anisotropic plane problems; three of them are solved: albedo and extrapolation length for the Milne problem, albedo and transmission for slabs, critical thickness for a multiplying medium. Problems in cylindrical geometry are treated in one-velocity theory with an isotropic scattering law: albedo for the inner and outer problems, extrapolation length of Milne problem, critical radius for a multiplying medium, albedo and transmission for a cylindrical annulus. The first accurate results for the extrapolation length of the Milne problem are presented. In spherical geometry, the same problems as in cylindrical one are solved. The fast neutron exponential experiment is the last problem treated. The three-dimensional problem is, by some approximations, reduced to one in plane geometry. For the calculation of the moments of the energy-dependent Green's function, the synthetic slowing-down kernels developed by M. Cadilhac, M. Pujol, H. Lorain are used. The extrapolation length and the reaction rates inside the medium are computed; the linear combination of reaction rate which minimizes the effects of the transients is given. (auth)

18403 (XDC-60-3-68) MULTI-GROUP, MULTI-REGION, ONE SPACE DIMENSION NEUTRON DIFFUSION THEORY CALCULATION. Program F-N (ANP No. 308). Fischer, P. G. (General Electric Co., Cincinnati, Ohio (USA). Aircraft Nuclear Propulsion Dept.). 15 Jan 1960. Contract AT(11-1)-171. 82p. Dep. NTIS $7.25.

This report covers both programming and analysis for a flexible multigroup neutron diffusion calculation program. The mathematical analysis, although not original, is given in detail in an effort to provide the program user with the results necessary to intelligent and physically reasonable application of the program and interpretation of the results. The program provides several important advantages over existing ANPD diffusion codes besides that inherently available with the FORTRAN-II automatic coding system, which will enable it to be rapidly and easily modified and extended to meet analysis requirements where Diffusion Theory is applicable. Thus, neutron energy change through any number of energy groups is directly representable—this allows inelastic scattering, (n, 2n) reactions, thermal up-scattering, etc., to be included in a completely straightforward manner; both direct and adjoint flux solutions may be generated and combined to yield variational optimum space averaging and eigenvalue calculations; the multigroup equation formulation, which consists of second-order difference equations with arbitrary coupling enables the program to be used, for example, to generate higher-order Legendre polynominal approximations to the Boltzmann equation in slab geometry or multiple single-axis flux solutions in flux synthesis applications. In addition, this formulation enables resonance self-shielding, spatial inhomogeneities, etc., to be represented in an entirely straightforward way, since only energy integrals are involved. This report completed Milestone I of Job 51324 under Task 4314-2-1. (auth)

18404 CCDN NEWSLETTER, NO. 74-2, OCTOBER 1974. Gif-sur-Yvette, France; NEA Neutron Data Compilation Centre (1974). 34p.

This copy of the CCDN Newsletter from the NEA Neutron Data Compilation Centre is concerned with CCDN news, evaluated data, and experimental data. The National Neutron Cross Section Centre (Brookhaven) has distributed parts of the fourth version of the U. S. file, ENDF/B-IV; the contents of those tapes received since publication of the last newsletter are listed. Indexes to experimental data from the CCDN service area (Western Europe and Japan) and from outside that area are given. (RWR)

18405 EFFECT OF THE ATMOSPHERIC AIR ON THE RESULTS OF TIME-OF-FLIGHT MEASUREMENTS OF A FISSION-NEUTRON SPECTRUM. Ivanov, O. I.; Safonov, V. A. Sov. At. Energy (Engl. Transl.); 36: No. 5, 504-506(May 1974).

Translated from At. Energ.; 36: No. 5, 397-399(May 1974).

Distortion due only to the surrounding air is considered; the scattering of neutrons by apparatus has a greater effect on the solid angle than on the spectrum. A Watt fission spectrum was used. The recorded time distribution can be represented as a superposition of two spectra: the spectrum of neutrons which have passed through a layer of air and that of neutrons which have been scattered into the detector by the surrounding medium. The detected spectrum and its deviation from the original spectrum were evaluated by computer. Results are shown for plastic and glass detectors. It was found that the effect of knocking-out of neutrons from the primary beam is largely compensated by neutrons scattered by the surrounding medium. The combined effect of these processes leads to a softening of the measured spectrum which increases with the flight base. The softening of the spectrum also depends on the size of the neutron detector. In a neutron spectrum measured with sufficiently high resolution there must be irregularities due to resonances in the total cross sections of O and N. When the low-energy part of a neutron spectrum is measured by detectors based on the ^{6}Li(n, α) reaction, the main role in distortion of the spectrum is played by the broad resonance of the cross section of Li in the region of 260 keV. The detection efficiency of scattered neutrons increases so markedly that the distortion of the spectrum is 15% at E_n = 0.03 MeV. It is doubtful whether such a background can be reliably taken into account in an experiment. (3 figures) (RWR)

18406 COLD NEUTRON SCATTERING LAW IN LIQUID BENZENE. Trepadus, V. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 7, 731-735(1974).

The experimental cold neutron scattering law for liquid benzene is here compared with the l derived law using the Larsson model. (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 18203, 18217, 18344, 18465, 18643, and 18649.

18407 (IPNO-T-74-05) STUDY OF CHARGE SYMMETRY IN SOME FEW-NUCLEON REACTIONS. Stephan, M. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire). 1974. 75p. (In French). Dep. NTIS (U. S. Sales Only) $6.75.

Thesis.

The (d,t) and (d,^{3}He) reactions on mass 2, 3 and 4 nuclei were studied at the Orsay synchrocyclotron. The particles were identified by the values of B rho, range, and ΔE as measured by a magnetic spectrometer followed by a telescope of scintillators. The angular distributions of the reactions d(d,t)p and d(d,^{3}He)n were measured at 83 MeV. The ratio of the cross sections $d\sigma/d\Omega(d,^3He)/d\sigma/d\Omega(d,t)$ oscillates slightly as a function of the angle around a mean value of 0.984 ± 0.28, which is compatible with 1. The energy spectra of tritons and ^{3}He-particles emitted at 2°, 5 and 7°, 5 in the reactions ^{3}He(d,t)2p and ^{3}H(d,^{3}He)2n were measured at 83 MeV. The interpretation of these spectra in term of final state interaction, by comparing the two mirror-reactions or through a modified Born approximation, does not give a precise determination of a nn. The angular distribution of the reaction $\alpha + d \rightarrow t + {}^3He$ at $E(\alpha)$ = 166 MeV ($E_{(C.M.)}$ = 55 MeV) shows a slight asymmetry about 90 deg in the center of mass system. (At most 6% ± 2%). Coulomb interaction as calculated in DWBA formalism, explains this violation of Barshay-Temmer predicted symmetry, the main features of the angular distribution are also reproduced. The results of these three experiments agree with the principle of charge symmetry. (auth)

18408 (ISN-TS-74-1) STUDY OF THE d(p,2p)n REACTION IN THE 60 TO 160 MeV ENERGY RANGE USING FADDEEV EQUATIONS WITH REALISTIC POTENTIALS. Issa, A. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires;

Grenoble-1 Univ., 38 (France)). 1974. 83p. (In French). Dep. NTIS (US Sales Only) $7.25.

Thesis.

The Faddeev integral equations for the d(p,2p)n reaction are solved by iteration. In the first term two different local potentials with S-P-D waves are used. The Yamaguchi potential is used in the calculation of the 2nd and 3rd terms. The numerical calculations performed for different kinematics at E(lab) = 58.5, 100, and 156 MeV, confirm that the rescattering series diverge that for the incident energies E(lab) < 100 MeV, except for the case of quasifree scattering. For energies between 100 and 160 MeV, the series seem to converge. The differences between the results of the 3rd order calculation, obtained by different potentials, are comparable to those for the free nucleon–nucleon scattering. This is related to the fact that the series are dominated by the single scattering term, which is nearly on-shell ($k_f/k_i = 0.80-0.97$). (auth)

18409 (ITF–73-96-R) SOLUTION OF THE INTEGRAL EQUATIONS FOR FOUR IDENTICAL PARTICLES. Kharchenko, V. F.; Kuz'michev, V. E.; Shadchin, S. A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1973. 36p. (In Russian). INIS.

By means of a separable concept of the scattering amplitudes for the subsystems 3 + 1 and 2 + 2, the integral equations of motion for four identical particles with a separable, two-particle interaction are reduced to a system of one-dimensional integral equations. By solving these equations, calculations were carried on the energies and wave functions of low lying O^+-states of a system of four identical bosons, and also the particle scattering length on a system of three particles in a bound state. Solutions were carried out on a system of integral equations describing the bound state of four nucleons with the approximation of a completely symmetrical, spacial wave function, and the binding energy and wave function of the ^{4}He nucleus were found. (tr–SJR)

18410 (JINR –E4-8263) MUON CAPTURE BY DEUTERON. Dogotar, G. E.; Eramzhayan, R. A.; Salganik, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. Dep. NTIS (US Sales Only) $4.25.

The muon capture by deuterons was considered. The following characteristics are investigated: the capture rate, energy spectrum and asymmetry of the neutron angular distribution. The calculation results are presented for three cases of the mesoatom initial state population: doublet, quartet, and statistical. (auth)

18411 (JINR-P1-8235) ELASTIC π ^{4}He SCATTERING IN IMPULSE APPROXIMATION. Georgesku, K.; Mikhul, A.; Falomkin, I. V.; Shcherbakov, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The scattering of pions on the ^{4}He nucleus in the energy interval from 50 to 150 MeV was investigated using the impulse approximation. The scattering amplitudes as functions of the spin and isospin were averaged. For approximating the experimental data three parameters were used: the radius of the nucleus, the P_{33} wave phase and ρ — the imaginary part introduced into the S-wave. Besides this the phases for free scattering were used. As a result a reasonably good description of the elastic π ^{4}He scattering for the given energy interval was obtained. (auth)

18412 (JINR-P1-8236) IMPULSE APPROXIMATION IN THE ELASTIC π ^{3}He SCATTERING. Georgesku, K.; Mikhul, A.; Falomkin, I. V.; Shcherbakov, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The π ^{3}He scattering was considered in the impulse approximation. The partial wave method was used, and the phases of free πN scattering were taken. The calculations as well as parametrization were performed for experimental data at 98 MeV. Three values were taken as the parameters: R_1 and R_2 — two radii of the ^{3}He nucleus, corresponding to two different nuclear form factors of the nucleus, and also the P_{33} wave phase. A sufficiently good description of experimental data was obtained. (auth)

18413 (LA-5732-MS) ABSOLUTE DIFFERENTIAL CROSS SECTIONS FOR NEUTRON PRODUCTION BY THE ^{2}H(d,n)^{3}He REACTION WITH E_d FROM 6 TO 17 MeV AND BY THE ^{3}H(p,n)^{3}He REACTION WITH E_p FROM 6 TO 16 MeV. Drosg, M.; Drake, D. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 8p. Dep. NTIS $4.00.

Differential cross sections of the ^{2}H(d,n)^{3}He reaction at 6, 7, 8, 10, 11, 12.305, 14, and 17 MeV and of the ^{3}H(p,n)^{3}He reaction at 7, 8.6, 9, 10, 11, 12, 13.6, 14, 15, and 16 MeV were measured using time-of-flight techniques. The absolute scales were established by using accurate ^{2}H(d,^{3}He)n cross sections at 10.0 MeV and ^{3}H(p,^{3}He)n cross sections at 13.6 MeV as cross section standards. The scale uncertainty for the ^{2}H(d,n)^{3}He data is ±1.5%; that for ^{3}H(p,n)^{3}He data, ±1.8%. Complete angular distributions were measured for the ^{2}H(d,n)^{3}He reaction. The data measured for the ^{3}H(p,n)^{3}He reaction were used to convert previously published relative distributions into absolute ones. The typical relative error is close to ±2%. (auth)

18414 RELATED CALCULATIONS INVOLVING NEARLY PURE STATES IN SOME LIGHT NUCLEI. Villet, C. M. (Stellenbosch Univ. (South Africa)). Dec 1973. 61p. INIS.

45 refs.; copies available from Atomic Energy Board, Pelindaba, Pretoria (South Africa).

The position of some spectral levels was predicted by relating them in an interaction-independent way to known spectra. The methods used required levels of very pure configurations. Three interaction matrix elements are reduced to functions of two-body interaction matrix elements, using only angular momentum algebra and Wick's theorem. The particle-hole transformation is used to predict the relative spacings of the ($d_{3/2}f_{7/2}$) and $d_{3/2}P_{3/2}$) levels of ^{38}Cl from the shape of the $d_{3/2}^{-1}f_{7/2}$) and $d_{3/2}^{-1}P_{3/2}$) spectra of ^{40}K, as well as the relative spacings of the ($f_{7/2}f_{7/2}$) levels of ^{42}Sc from the shape of the ($f_{7/2}^{-1}f_{7/2}$) spectrum of ^{48}Sc. The predicted spectra are in extremely good agreement with experiment. The relations derived are used to predict the one-particle spectra of ^{13}C and ^{17}O from a knowledge of the ($p_{1/2}s_{1/2}$) and ($p_{1/2}d_{5/2}$) levels of A = 14 nuclei and the ($p_{1/2}^{-1}d_{5/2}$) and ($p_{1/2}s_{1/2}$) levels of A = 16 nuclei. The predicted spectra are in very good agreement with experiment, and the inversion of the $s_{1/2}$ and $d_{5/2}$ levels of ^{17}O is obtained. (auth)

18415 POLYNOMIAL COEFFICIENTS FOR THE VECTOR ANALYZING POWER OF (dd)$^-$ REACTIONS. Nemets, O. F.; Yasnogorodskij, A. M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 741-745(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

Expressions were obtained for the expansion coefficient of the vector analyzing power of (dd) reactions in series according to associated Legendre polynomials. These expressions contain matrix elements of the transitions between states of entry and exit channels with similar field moments and parities with consideration of the S, P, D, F, and, particularly, G waves. (tr-auth)

18416 ANALYSIS OF THE ^{2}H(dp)^{3}H REACTION WITH POLARIZED DEUTERONS. Nemets, O. F.; Rudchik, A. T.; Yasnogorodskij, A. M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 746-751(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

An analysis was made of the results of the measurement of the vector analyzing power of the reaction ^{2}H(d,p)^{3}H reaction at energy around 12 MeV by approximation by means of systems of associated Legendre polynomials. In order to describe the vector analysing power it is sufficient to take into consideration polynomials up to the fourth order. The values obtained for the polynomial coefficients were examined with consideration of the possible effect of the resonance in ^{4}He. (tr-auth)

18417 TREJAM–YANG CRITERION AND THE ^{1}H(d,2p)n REACTION AT LOW ENERGIES. Avakov, G. V.; Dolinskij, Eh. I. (Moskovskij Gosudarstvennyj Univ. (USSR). Inst. Yadernoj Fiziki). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 844-848(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The differential cross section for the reaction ^{1}H(d,2p)n reaction at deuteron energies of 20 MeV was calculated in the polar approximation. The contributions from the mechanism of quasi-elastic scattering of the proton target on the neutron and of the deuteron by the proton and the uniformity of the protons were calculated. The calculated results were compared with experimental data. (tr-auth)

18418 THREE–BODY PHOTODISINTEGRATION OF ^{3}He. Berman, B.L.; Fultz, S.C.; Yergin, P.F. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. C 10: No. 6, 2221-2236 (Dec 1974).

The photoneutron cross section for ^{3}He has been measured from threshold to 30 MeV using monochromatic photons from positron annihilation in flight. The cross section reaches its maximum of about 0.95 mb at about 15 MeV. Several distinct structures are apparent, some correlated with observed fore–aft asymmetry of the photoneutrons. The integrated cross section is 13.0 MeV mb, and the 1/E integrated cross section is 0.77 mb. With reasonable extrapolations to higher energies this is consistent with sum—rule predictions, well within experimental uncertainties. Current theoretical calculations are capable of accounting for the over—all size and shape of the cross section, but not for the fine details of the present measurement. (auth)

18419 BINDING ENERGY OF THE DEUTERON: A LABORATORY EXPERIMENT. Mudhole, T.; Umakantha, N. (Department of Physics, Karnatak University, Dharwar, India 58003). Am. J. Phys. 43: No. 1, 104-105 (Jan 1975).

The binding energy of the deuteron is determined by studying the monoenergetic photons produced in the capture of thermal neutrons by protons. (AIP)

18420 VECTOR—TO—VECTOR POLARIZATION TRANSFER IN DEUTERON—PROTON ELASTIC SCATTERING. Rad, F.N.; Birchall, J.; Conzett, H.E.; Roy, R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. Lett. 33: No. 26, 1579-1581 (23 Dec 1974).

An angular distribution of the polarization transfer coefficient $K_y^{y'}(\theta)$ in d—p elastic scattering has been measured at E_d = 45.4 MeV. Our results are in very good agreement with the prediction of a recent three—body calculation. (auth)

18421 SIMPLE DETERMINATION OF THE NUCLEAR MASS OF DEUTERIUM. Eaton, T. W.; Smith, R. (Sheffield Polytechnic, Eng.). Phys. Educ.; 9: No. 7, 485-486(Nov 1974).

The nuclear mass of deuterium is determined from the wavelength difference between the red lines in the Balmer series of hydrogen and deuterium, measured by the method of coincidences using a Fabry—Perot interferometer and an arc source filled with equal amounts of the two gases. The experiment clearly demonstrates the effect of finite nuclear mass in modifying the simple Bohr model of single electron atoms and the capability of a Fabry—Perot interferometer to resolve spectral lines differing in wavelength by 10 nm. This experiment could form a useful experiment for students in schools and colleges. (UK)

18422 THEORY OF THREE-NUCLEON SYSTEMS. Kim, Y. E.; Tubis, A. (Purdue Univ., Lafayette, IN). Annu. Rev. Nucl. Sci.; 24: 69-100(1974).

A review of some of the major developments in the three-nucleon problem since 1969 is given. These developments include the following: systematic and practical techniques for constructing realistic phase-equivalent potentials (families of two-nucleon potentials having the same OPE tail but different intermediate and short-range behaviors and giving the same fit to two-nucleon data) and accurately calculating their associated three-nucleon observables; new advances in three-body scattering theory and its generalization to the N-body problem; tests of modern theories of meson-exchange currents in weak and electromagnetic processes involving three nucleons; and new data on ^{3}He electromagnetic form factors at high momentum transfers and its theoretical interpretation. The bound states (^{3}H, ^{3}He) are discussed with respect to binding energies and wave functions, effects of three-nucleon forces, asymptotic normalization parameters, and ^{3}H—^{3}He energy difference. Under the topic of scattering and breakup, scattering lengths, elastic scattering, breakup, and polarization are examined. Throughout the review, comparisons of theoretical results with experimental data and the sensitivity of various three-nucleon observables to the details of the nuclear forces are emphasized. (291 references) (RWR)

18423 MATRIX SOLUTION OF THE BETHE—FADDEEV EQUATIONS. Halderson, D.W.; Goldhammer, P. (Department of Physics, University of Kansas, Lawrence, Kansas 66045). Phys. Rev. C 11: No. 1, 237-242 (Jan 1975).

The Bethe—Faddeev equations are set up in matrix form and solved for the ^{3}H nucleus. The two—body g matrix is derived from a revised version of the Brueckner—Bethe—Goldstone formalism. Application to the Reid soft-core potential indicates that this interaction yields an eigenvalue very close to the experimental binding energy of ^{3}H. (auth)

18424 MAGNETIC MOMENT OF THE DEUTERON AND PHENOMENOLOGICAL MODELS OF THE NUCLEON—NUCLEON INTERACTION. Scheerbaum, R.R. (Department of Physics, Texas A&M University, College Station, Texas 77843). Phys. Rev. C 11: No. 1, 255-258 (Jan 1975).

Various aspects of the Yale, Hamada—Johnston, and Reid nucleon—nucleon potentials which pertain to the deuteron magnetic moment are discussed. The total deuteron magnetic moment is calculated for each of these potentials and the results, together with their significance, are briefly discussed. (auth)

18425 MEASUREMENT OF THE NEUTRON—PROTON TOTAL CROSS SECTION AT 132 eV. Dilg, W. (Physik—Department, E 14, Technische Universität München, München, Germany). Phys. Rev. C 11: No. 1, 103-109 (Jan 1975).

The neutron—proton scattering cross section at "zero energy" (σ_0), which is an important experimental parameter in the analysis of low energy *np* data, has been accurately redetermined by transmission measurements at 132 eV neutron energy on H_2O, C_6H_6, CH_3OH, and C_7H_8. We obtain the total cross sections per molecule (132 eV) 44.731 ± 0.027, 151.40 ± 0.10, 90.37 ± 0.08, and 197.20 ±0.34 b, respectively. To evaluate σ_0 we subtract the well—known cross sections of carbon and oxygen, and correct for the small contributions ($<0.1\%$) of capture, molecular binding, effective range, and deuterium. Combining all known errors from the experimental and evaluation procedure, we find $\sigma_0 = 20.491 \pm 0.014$ b. This is 0.27%, or 2.4 standard errors, above the best previous measurement by Houk, and ~0.6% above the mean of former data. Our result of σ_0 implies changes in the *np* effective—range parameters towards higher values, by about twice the present standard errors in a_s, a_t, and r_{0t} and 1 standard error in r_{0s}. (auth)

18426 NEGATIVE PION CAPTURE IN ^{3}He. McCarthy, J.; Meyer, T.; Minehart, R.C.; Wadlinger, E.A.; Ziock, K.O.H. (Physics Department, University of Virginia, Charlottesville, Virginia 22901); Vincent, J. Phys. Rev. C 11: No. 1, 266-268 (Jan 1975).

A measurement of the branching ratio for the two-body final state $\pi^- + {}^3\text{He} \rightarrow d + n$ yielded 15.9 ± 1.6%. (auth)

18427 EXTRACTION OF a_{nn} FROM THE REACTION $\pi^- d \rightarrow \gamma nn$. Gibbs, W.R.; Gibson, B.F.; Stephenson, G.J. Jr. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544). Phys. Rev. C 11: No. 1, 90-99 (Jan 1975).

Extraction of a value for the neutron—neutron scattering length by an analysis of the reaction $\pi^- + d \rightarrow \gamma + n + n$ necessitates making assumptions about the reaction amplitude. We have studied the sensitivity of the extracted value of a_{nn} to such an analysis by performing a series of theoretical experiments in which a standard set of assumptions is used to analyze data generated by variations in one or more of these assumptions. For kinematically complete experiments the major sources of uncertainty lie in the energy dependence of the short—range characterization of the $n-n$ final—state wave function and, to a lesser extent, the treatment of the pion wave function in the initial state. We conclude that a value of a_{nn} can be extracted from this experiment with a theoretical uncertainty of less than 0.3 fm. (auth)

18428 TWO—BODY PHOTODISINTEGRATION OF ^{3}He AND ^{3}H. Gibson, B.F. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544); Lehman, D.R. Phys. Rev. C 11: No. 1, 29-42 (Jan 1975).

Cross sections for two—body photodisintegration of ^{3}He and ^{3}H are calculated in electric—dipole approximation. The calculation is performed within the context of exact three—body theory with the two—nucleon interactions represented by *s*—wave spin—dependent separable potentials fitted to the low—energy nucleon—nucleon scattering data. The two—body photodisintegration amplitude is expressed in terms of the half—off—shell nucleon plus correlated—pair amplitudes, a method applicable to any weak—process disintegration amplitude. The numerical results indicate: (1) The ^{3}He and ^{3}H 90° photodisintegration cross sections are essentially identical in shape, being only slightly displaced at low energy due to the different thresholds, when both initial and final states are treated consistently. (2) The $^3\text{He}(\gamma, d)p$ 90° differential cross section has a peak value of approximately 95 μb/sr. (auth)

18429 ATTRACTIVE POTENTIAL WITH FORBIDDEN STATES FOR THE *N—N* INTERACTION. Neudatchin, V.G. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Obukhovsky, I.T.; Kukulin, V.I.; Golovanova, N.F. Phys. Rev. C 11: No. 1, 128-136 (Jan 1975).

A potential model with forbidden states for describing the nucleon—nucleon interaction in the inner region is suggested. Forbidden states in the *N—N* system may occur due to the composite structure of nucleons as a consequence of the Pauli exclusion principle. A consistent description of singlet-even phase shifts at energies up to 400 MeV has been obtained. The generalization of Levinson's theorem taking forbidden states into account permits a new interesting interpretation of the phase—shift analysis data at higher energies, and as a result gives a "smooth matching" of the low—energy phase shifts with the asymptotic region $E \gtrsim 10$ GeV. The loop which the wave function has in the inner region provides a considerable contribution to the deuteron form factor at great momentum transfers. A comparison is made with the repulsive core model. Possible consequences for the three— and many—nucleon systems are discussed. (auth)

18430 PROTON—NUCLEUS SCATTERING AT MEDIUM ENERGIES. Saudinos, J. (CEN, Saclay, France); Wilkin, C. Annu. Rev. Nucl. Sci.; 24: 341-377(1974).

This review is concerned solely with (p,p') reactions and total cross sections which are related to the elastic amplitude via unitarity. The paper begins with a directory of experimental results, and then proceeds to discuss the experimental problems, including the magnetic spectrometer, kinematics and beam energy dispersion, angular resolution and counting rate, block diagram of an experiment, and various experimental setups. Next, the Glauber theory and optical potentials are considered, with emphasis on the former. Several pages are then devoted to each of the following subjects: elastic scattering, polarization experiments and the effects of spin dependence, the excitation of discrete nuclear levels, and sum rules and correlations. (12 figures, 4 tables, 127 references) (RWR)

Nuclear Properties and Reactions, $6 \leq A \leq 19$

Refer also to abstracts 17605, 18203, 18414, 18430, 18480, 18483, 18486, 18509, 18515, 18536, 18546, 18547, 18617, 18649, and 18663.

18431 (COO-3071-110) REALISTIC CALCULATIONS OF THE $(\pi^-,n\gamma)$ REACTION. Lee, T. S. H.; Vergados, J. D. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 30 Aug 1974. 15p. Dep. NTIS $4.00.

The $(\pi^-,n\gamma)$ reaction was investigated within the direct reactions formalism employing the CGLN interaction and realistic nuclear and distorted neutron wave functions. The results for ^{14}N can account for the quasifree background observed in radiative capture of stopped pions, but they predict gross structure. Comparisons with the phenomenological pole model are made. (auth)

18432 (IPNO/TH-73-47) RADIATIVE PION CAPTURE IN ^{12}C AND ^{16}O. Ohtsubo, H.; Nishiyama, T.; Kawaguchi, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Nov 1973. 46p. Dep. NTIS (US Sales Only) $5.50.

Radiative pion capture in ^{12}C and ^{16}O is investigated. The effective interaction Hamiltonian based upon the CGLN (Chew, Goldeberger, Low and Nambu) theory is employed. Capture rates in ^{12}C and ^{16}O from 1s- and 2p-pionic orbits are calculated by using the nuclear model of Kaminura, Ikeda and Arima for odd parity states of ^{12}C and of Walker with strong ground state correlation for odd parity states of ^{16}O. Results are compared with those of nuclear model of one-particle-hole pair under Tamm-Dancoff and random phase approximation by Gillet and Vinh Mau. Detailed examinations are made for the transitions into low lying states with 1^+ and 2^+ for ^{12}C and with 1^-, 2^- and 3^- for ^{16}O by using the Cohen-Kurath model and the Walker model respectively. Results are in good agreement with the recent experimental data of Berkeley. (auth)

18433 (JINR-1-7839) SOME SPECIFIC FEATURES OF PION–CARBON INTERACTIONS AT 5 GeV/c. Azimova, M.; Azimov, S. A.; Igamberdiev, K. R.; Lutfullaev, S. L.; Meerzon, E. V.; Rizaev, Kh. A.; Sosnik, V. P.; Usmanov, T. M.; Yuldashev, A. A.; Budagov, Yu. A.; Volod'ko, A. G.; Yuldashev, R. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 18p. (In Russian). INIS.

The multiplicity of secondary charged particles and proton pair correlation in π^--C interactions at 5 GeV/c was studied with the one-meter propane bubble chamber. Comparison of the data obtained on multiplicity with data obtained at 40 GeV/c indicates the possibility of the existence of KNO scaling at $E \geq 5$ GeV. The study of the proton pair correlation confirmed the existence of correlated proton flight previously observed in π^--C interactions at 4 and 7.5 GeV/c. (tr-auth)

18434 (JINR-P1-8252) STUDY OF THE REACTION $\mu^-\ {}^{12}C \rightarrow {}^4He{}^4He{}^3Hn\nu$. Batusov, Yu. A.; Bunyatov, S. A.; Vizireva, L.; Gulkanyan, G. R.; Mirsalikhova, F.; Sidorov, V. M.; Chernev, Kh. M.; Eramzhyan, R. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The reaction $\mu^-\ {}^{12}C \rightarrow {}^4He{}^4He{}^3Hn\nu$ was investigated experimentally. The upper limit of its relative probability is determined to be $W \lesssim 2 \cdot (10)^{-2}$. Possible mechanisms of the reaction are considered. It is shown that, at the probability of $(1.1 \pm 0.1) \cdot 10^{-2}$ per the capture act, this reaction proceeds according to the scheme predicted by the resonance mechanism of the μ^--meson capture by a carbon nucleus. (auth)

18435 (JINR-P15-8217) STUDY OF THE REACTION $^{14}N(^3He,p)^{16}O$. Osetinskii, G. M.; Semenov, V. M.; Son Von Nahm; Faruk, M. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

In the energy range of 2.0 to 4.0 MeV the differential cross sections of the reaction $^{14}N(^3He,p)^{16}O$ were measured for the groups $p_{1,2}$, p_3, p_4, p_5, p_7. For the same groups of protons the angular distributions were measured in the angle range of 2 to 165° l.s. The possibility is considered of a description of the obtained results with the help of the distorted wave Born approximation taking into account the compound nucleus mechanism by the Hauser-Feschbash method. The residual force shell model application to the spectroscopic calculations of the excited ^{16}O states is investigated. (auth)

18436 (JINR–P15-8218) STUDY OF THE REACTION $^{14}N(^3He,\alpha)^{13}N$. Golubev, S. L.; Osetinskii, G. M.; Fryshchin, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Neutron Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The excitation curves of the reaction $^{14}N(^3He,\alpha)^{13}N$ are measured for the channels α_0, α_1, at the angles 45, 90, 135° in the energy range of 2.2 to 4.06 MeV with the help of a gas target using the JINR electrostatic generator. The angular distributions, measured for α_0 channel, were analyzed by the distorted wave Born approximation method and by the Hauser-Feschbach statistical theory. The spectroscopic factors are obtained. (auth)

18437 (ORO-2972-279, pp 23-26) $^{17}O(^3He,p)^{19}F$ REACTION. Bishop, J. 1974.

In annual report, 1974.

18438 (ORO-2972-279, pp 37-54) DOUBLE GAMMA-RAY DECAY EXPERIMENTS USING THE NUCLEI OF ^{90}Zr, ^{16}O, AND ^{12}C. Braithwaite, W. J.; Obst, A. W.; King, C. H. 1974.

In annual report, 1974.

18439 CLASSIFICATION OF THE FRACTIONAL PARENTAGE COEFFICIENTS FOR ONCE-EXCITED U(3(n-1)) STATES OF NUCLEI WITH N LESS THAN OR EQUAL TO 16 BY QUANTUM NUMBERS OF THE ORTHOGONAL GROUP. Sabalyauskas, L. Yu.; Yankauskas, K. I.; Petrauskas, A. K. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 2, 207-234 (1974). (In Russian).

The equations for the classification of one-particle parentage coefficients by quantum numbers of the orthogonal group for one-excited U(3(n−1))-states of nuclei with $n \leq 16$ are obtained. The numerical tables of these coefficients for nuclei with n = 13 to 16 are given and the correspondence between the fractional parentage decompositon of hyperspherical functions and the U(3(n−1)) scheme functions is pointed out. (auth)

18440 SCATTERING OF 20- AND 24.5 MeV POLARIZED PROTONS ON NUCLEI WITH THE MASS NUMBER A FROM 12 TO 40. Plavko, A. V.; Lonbar, R. M.; Gosse, Zh.; Kudryashov, V. I.; Majer, B. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 878-882 (Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The analyzing power during inelastic scattering of polarized protons with excitation of the 3.68 MeV, $1/2^+$ level of ^{27}Al, the 4.97 MeV, 0^+ level for ^{28}Si, and the 3.35 MeV, 0^+ level of ^{40}Ca was studied. Some characteristics in the polarization phenomena were discussed. (tr-auth)

18441 ENERGY DEPENDENCE OF PROTON POLARIZATION IN ELASTIC SCATTERING ON ^{9}Be IN THE ENERGY RANGE FROM 4.4 TO 5.4 MeV. Gulamov, I. R.; Romanovskij, E. A.; Spasskaya, T. I. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 860-862(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The possibility of measuring the continuous energy dependence of the polarization during elastic scattering of protons by use of a polarized proton beam of fixed energy and the thick-target method for determination of the left-right asymmetry appearing during scattering was shown. (tr-auth)

18442 STUDY ON THE (d, ^{6}Li) REACTION ON ^{12}C AND ^{16}D NUCLEI. Gass, A. S.; Goryunov, O. Yu.; Dobrikov, V. N.; Makovska-Zheshutko, M. G.; Nemets, O. F.; Rudchik, A. T. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 873-877(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The differential cross sections of the $^{12}C(d,{}^6Li)\,{}^8Be$ (ground) and $^{16}O(d,{}^6Li)\,{}^{12}C$ (ground) reactions were studied for deuterons with energy of 13.6 MeV at the INR cyclotron. The pickup of α

particles in the distorted wave approximation was used for interpretation of the data. (tr-auth)

18443 ELASTIC AND INELASTIC SCATTERING OF PROTONS ON ^{16}O NUCLEI. Zelenskaya, N. S.; Il'in, I. M.; Romanovskij, E. A. (Moskovskij Gosudarstvennyj Univ. (USSR). Inst. Yadernoj Fiziki). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 855-859(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

In the plane wave impulse approximation the relative differential cross sections in the elastic and inelastic (with excitation of the 6.92-MeV 2^+ level) scattering of protons on ^{16}O were obtained when the incident nucleon is scattered either on virtual nucleons or on virtual α particles at proton energies of 30, 40, 90, and 150 MeV. The calculations indicated that the contribution from scattering on virtual α particles is rather significant. (tr-auth)

18444 ON THE ASYMPTOTIC REPRESENTATION OF THE THREE-PARTICLE EIGENFUNCTIONS. Merkur'ev, S. P. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 840-843(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

Systems of two and three nonrelativistic particles, interacting by means of pair short-range potentials were examined. The asymptotic form of the eigenfunctions was established for the three-particle system. Proof of the asymptotic formula was given on the basis of the Faddeev equation. (INIS)

18445 ON THE INELASTIC SCATTERING OF PROTONS BY ^{9}Be AND ^{10}B NUCLEI. Gubin, V. B.; Romanovskij, E. A. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 752-756(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The angular dependence of the cross section and the polarizations of the protons during scattering on ^{9}Be with the excited levels 1.68 and 2.43 MeV and on ^{10}Be with the excited levels 0.717 and 2.15 MeV were calculated in the Born approximation with distorted waves for a series of energies. The calculations were compared with experiments. For small scattering angles the calculations gave a negative polarization in excited levels of the same parity as that of the ground state and a large positive polarization during excitation of the 1.68 MeV level in ^{9}Be, whose parity is opposite to the parity of the ground state. (tr-auth)

18446 COMPLETE ISOBARIC QUINTET. Robertson, R.G.H.; Chien, W.S. (Cyclotron Laboratory and Physics Department, Michigan State University, East Lansing, Michigan 48824); Goosman, D.R. Phys. Rev. Lett. 34: No. 1, 33-36 (6 Jan 1975).

By experimental observation of the lowest T=2 states in ^{8}B and ^{8}Li, an isobaric quintet has been completed for the first time. The T=2 state in ^{8}B, populated via the reaction ^{11}B(^{3}He, ^{6}He)^{8}B, lies at 10.619±0.009 MeV excitation, and its analog in ^{8}Li, found in ^{10}Be(p, ^{3}He)^{8}Li, lies at 10.8222±0.0055 MeV. The excitation of the previously known T=2 state in ^{8}Be was measured by ^{10}Be(p,t)^{8}Be to be 27.4922±0.0027 MeV. A significant departure from the isobaric–multiplet mass equation is indicated. (auth)

18447 A MORE ACCURATE MASS FOR ^{8}He. Cerny, J.; Jelley, N.A.; Hendrie, D.L.; Maguire, C.F.; Mahoney, J.; Scott, D.K.; Weisenmiller, R.B. (Department of Chemistry and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. C 10: No. 6, 2654-2656 (Dec 1974).

The ^{26}Mg(α, ^{8}He)^{22}Mg reaction was reinvestigated at a bombarding energy of 110.6 MeV with a magnetic spectrometer–multiwire proportional counter detection system, leading to an improved value for the mass excess of ^{8}He of 31.57 ± 0.03 MeV. (auth)

18448 PION PHOTOPRODUCTION ON ^{6}Li NEAR THRESHOLD. Koch, J.H.; Donnelly, T.W. (Institute of Theoretical Physics, Department of Physics, Stanford University, Stanford, California 94305). Phys. Rev. C 10: No. 6, 2618-2619 (Dec 1974).

We present the results of an improved calculation of pion photoproduction on ^{6}Li near threshold and compare with the recent data of Deutsch et al. The theoretical cross sections are found to be about 60% higher than the experimental values. (auth)

18449 STUDY OF THE REACTION ^{12}C(^{12}C, d)^{22}Na. KeKelis, G.; Fox, J.D. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 10: No. 6, 2613-2615 (Dec 1974).

Excitation functions for the reaction ^{12}C(^{12}C, d)^{22}Na in the energy range 37–44 MeV (lab) are compared to those for the ^{12}C(^{12}C, p)^{23}Na reaction. Evidence is presented that the different channels "resonate" at different energies. (auth)

18450 FIRST EXCITED A = 9 ISOSPIN QUARTET. Benenson, W.; Kashy, E. (Cyclotron Laboratory and Physics Department, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. C 10: No. 6, 2633-2635 (Dec 1974).

The first excited state of ^{9}C and its analog in ^{9}B have been observed, and their mass excesses and widths have been measured. This completes a new mass quartet which differs from the predictions of the isobaric multiple mass equation less significantly than the ground state A = 9 quartet. (auth)

18451 EXCITATION ENERGY OF THE SECOND EXCITED STATE OF ^{12}C. Jolivette, P.L.; Goss, J.D.; Rollefson, A.A.; Browne, C.P. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. C 10: No. 6, 2629-2630 (Dec 1974).

The excitation energy of the second excited state of ^{12}C is measured to be 7655.2 ± 1.1 keV. The current best value, including the present work, for the $3\alpha - {}^{12}$C(7.65 MeV) Q value is 380.1 ± 1.0 keV. (auth)

18452 EFFECT OF REARRANGEMENT ON THE SINGLE–PARTICLE FIELD OF ^{16}O. Rouben, B.; Padjen, R. (Laboratoire de Physique Nucléaire, Université de Montréal, C.P. 6128, Montreál 101, Québec, Canada); Saunier, G. Phys. Rev. C 10: No. 6, 2561-2567 (Dec 1974).

Both the third–order and the second–order rearrangement corrections are included in a self–consistent calculation of the single–particle field of ^{16}O, carried out with a model G matrix derived from the soft–core Sprung–de–Tourreil interaction. Saturation is improved: The charge radius increases by 7% and the central nuclear density is diminished by 10%. For the interaction chosen, the effects of the second–order (energy–dependent) corrections are larger than those of the third order. The self–consistent "single–particle" energies in the nucleus, and the single–particle wave functions, are used to calculate the removal energies of single particles, the results being in quite good agreement with experiment. (auth)

18453 NEW HIGH–SPIN STATE AT 3.95 MeV IN ^{19}O. Fortune, H.T.; Bingham, H.G. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 10: No. 6, 2174-2175 (Dec 1974).

Results of the ^{13}C(^{7}Li,p)^{19}O reaction, at a bombarding energy of 16.0 MeV, suggest the existence of a new state at 3946.8 ± 2.5 keV in ^{19}O, having $J^\pi = 7/2^-, 9/2^+, 11/2^+$, or $13/2^+$ with $9/2^-$ or $7/2^-$ preferred. (auth)

18454 MEASUREMENTS OF THE PROTON TOTAL REACTION CROSS SECTION FOR LIGHT NUCLEI BETWEEN 20 AND 48 MeV. McGill, W.F. (Department of Physics, University of California, Los Angeles, California 90024); Carlson, R.F.; Short, T.H.; Cameron, J.M.; Richardson, J.R.; Šlaus, I.; van Oers, W.T.H.; Verba, J.W.; Margaziotis, D.J.; Doherty, P. Phys. Rev. C 10: No. 6, 2237-2246 (Dec 1974).

Measurements of proton total reaction cross sections for ^{9}Be, C, ^{19}F, ^{27}Al, and Si have been made in the energy range 20 to 48 MeV. These measurements were made using a variation of a standard attenuation technique. The cross sections are compared with various theoretical predictions. (auth)

18455 ELASTIC SCATTERING OF NEGATIVE PIONS FROM ^{16}O AND Ca IN THE 3,3 RESONANCE REGION. Blecher, M.; Gotow, K.; Anderson, D.K. (Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061); Kerns, R.; Minehart, R.; Ziock, K.; Bercaw, R.W.; Vincent, J.S.; Johnson, R. Phys. Rev. C 10: No. 6, 2247-2256 (Dec 1974).

The elastic scattering cross sections for $\pi^- - {}^{16}$O and $\pi^- -$Ca have been measured at pion kinetic energies 160, 170, 220, 230, and 240 MeV for ^{16}O, and 205 and 215 MeV for Ca. The results are analyzed in terms of the Kisslinger and Laplacian optical model potentials and the obtained potential parameters are compared with the impulse approximation result. (auth)

18456 NEUTRON RESONANCE SPECTROSCOPY: FLUORINE. Singh, U.N.; Liou, H.I.; Rainwater, J.; Hacken, G. (Columbia University, New York, New York 10027); Garg, J.B. Phys. Rev. C 10: No. 6, 2147-2149 (Dec 1974).

Results are reported of high-resolution transmission measurements on Teflon, $(CF_2)_n$, for the total cross section of natural fluorine vs energy from 500 eV to 200 keV. This region has three strong l = 1 levels which were fitted using a multilevel R–matrix analysis. The best fit (E_0, J, Γ_n) parameters are (26.99, 2, 0.325), (48.78, 1, 1.67), and (97.50, 1, 14.5), where E_0 and Γ_n are in keV. The results are consistent with previous measurements. They yield $10^4 S_1 = (11.1^{+12.4}_{-5.2})$ for ^{19}F using a 5 fm channel radius. (auth)

18457 TARGET CORRELATIONS IN THE CONTINUOUS (d,^{3}He) REACTION SPECTRUM. Strobel, G.L. (University of

Georgia, Department of Physics and Astronomy, Athens, Georgia 30602). Phys. Rev. C 10: No. 6, 2153-2158 (Dec 1974).

The (d,^{3}He) reaction spectrum is calculated in a plane-wave one–step direct reaction model. Target correlations due to a residual interaction are included. The discrete spectrum is dominated by the continuous spectra, at energies where both contribute. As a result the comparatively smooth experimental spectra can be understood in this reaction model. (auth)

18458 FURTHER EVIDENCE FOR ANOMALOUS ANGULAR DISTRIBUTIONS FOR TRANSITIONS TO THE $2s_{1/2}$ STATES IN THE MASS–13 SYSTEM. Nair, K.G.; Voit, H. ; Hamm, M.; Towsley, C.; Nagatani, K. (Cyclotron Institute and Physics Department, Texas A & M University, College Station, Texas 77843). Phys. Rev. Lett. 33: No. 26, 1588-1590 (23 Dec 1974).

The reaction ^{12}C(^{10}B,^{9}Be)^{13}N is investigated at 100 MeV with special emphasis on the transition to the first excited state in ^{13}N at 2.37 MeV. An anomaly in the angular distribution for the latter transition is observed similar to the one reported earlier by De–Vries et al. in a study of the reaction ^{12}C(^{14}N,^{13}N)^{13}C(3.09,1/2^{+}). (auth)

18459 THRESHOLD PHOTOPRODUCTION OF PIONS ON ^{6}Li. Cannata, F.; Lucas, C.W. Jr.; Werntz, C.W. (The Catholic University of America, Washington, D.C. 20017). Phys. Rev. Lett. 33: No. 21, 1316-1319 (18 Nov 1974).

We examine the dependence of the ^{6}Li(γ,π^{+})^{6}He cross section on the pion optical potential and on the nuclear size parameters within the context of the distorted–wave impulse approximation. Other factors affecting the cross section are also considered, and it is shown that the theoretical prediction remains about 60% higher than the observed cross section. Comparison to radiative pion capture in ^{6}Li is made. (auth)

18460 CORRELATION BETWEEN THE (d, γ_0) AND (p, γ_0) CROSS SECTIONS IN THE GIANT DIPOLE RESONANCE OF ^{16}O. Danos, M. (National Bureau of Standards, Washington, D.C. 20234); Weller, H.R. Phys. Rev. C 10: No. 6, 2627-2628 (Dec 1974).

The reaction theory of Fano is applied to the analysis of the ^{15}N(p, γ_0)^{16}O data vis à vis the ^{14}N(d, γ_0)^{16}O data. The result is consistent with the Gillet model, which attributes the structure near 22.9 MeV in ^{16}O to a 2p–2h quasibound state. (auth)

18461 ELASTIC SCATTERING OF ^{3}He BY ^{9}Be AND ^{28}Si. Bondouk, I.; Saleh, Z. A.; Machali, F.; Darwish, D. A. (Atomic Energy Establishment, Cairo). Rev. Roum. Phys.; 19: No. 6, 653-660(1974).

Differential cross sections for the elastic scattering of ^{3}He from ^{9}Be and ^{28}Si were measured in the $E_{^{3}He}$ = 1.20 to 2.50 MeV region at four scattering angles. The ^{9}Be (^{3}He, ^{3}He)^{9}Be cross sections are smooth over the entire energy range and show no clear resonance behavior. Angular distributions from 60 to 150° (Lab) were measured in 200 keV steps from 1.60 to 2.40 MeV and optical model analysis of these data was made. Good fits were obtained with a surface absorption potential. The ^{28}Si(^{3}He, ^{3}He) ^{28}Si cross sections follow the Rutherford cross sections in the entire energy range. (auth)

18462 OPTICAL MODEL ANALYSIS OF ^{9}Be(d,d)^{9}Be AT 1.1 TO 2.5 MeV. Bondouk, I. I. (Atomic Energy Establishment, Cairo). Rev. Roum. Phys.; 19: No. 8, 843-846(1974).

The differential cross sections for the elastic scattering of deuterons by ^{9}Be were analyzed in terms of the optical model using both surface and volume absorptions. Good fits were obtained with optical model potentials of real well depths in the region of 100 MeV. (auth)

18463 EXCITATION FUNCTIONS FOR ^{7}Be PRODUCTION BY LIGHT–ION BOMBARDMENT OF ^{12}C. Fulmer, C.B. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Goldberg, D.A. Phys. Rev. C 11: No. 1, 50-53 (Jan 1975).

We have measured excitation functions for production of ^{7}Be by d–, ^{3}He–, and α–particle–induced reactions in carbon using the stacked–foil method. Similar measurements for protons were obtained earlier. For each particle the data extend beyond 75 MeV. The ^{7}Be yields approach zero, respectively, in the neighborhood of threshold energies for the (p, ^{6}Li), (d, ^{7}Li), (^{3}He, ^{8}Be), and (α, ^{9}Be) reactions. The p– and ^{3}He–induced yields have similar energy dependences, peaking at roughly 10 MeV above threshold; in contrast, the maximum cross sections for the d and α curves occur 30–50 MeV above threshold energies. The maximum yield from ^{3}He–induced reactions (98 mb) is about a factor of 3 larger than that for p, d, or α. These results suggest that α–particle pickup may be an important part of the ^{7}Be yield at the lower energy part of the ^{3}He excitation function. (auth)

18464 MECHANISM OF (p, t) AND (p, ^{3}He) REACTIONS BY THE ANALYSIS OF THE ENERGY DEPENDENCE OF MIRROR TRANSITIONS. Micheletti, S.; Pignanelli, M.; Guazzoni, P. (Istituto di Scienze Fisiche dell'Università di Milano, Italy and Istituto Nazionale di Fisica Nucleare, Sezione di Milano, Italy). Phys. Rev. C 11: No. 1, 64-72(Jan 1975).

The reactions ^{13}C(p,t)^{11}C, ^{13}C(p,^{3}He)^{11}B, ^{16}O(p,t)^{14}O, and ^{16}O(p,^{3}He)^{14}N have been studied at several incident energies between 24 and 44 MeV. Previous results on the ^{15}N(p, t)^{13}N and ^{15}N(p, ^{3}He)^{13}C reactions are also considered in the analysis. The energy dependence of cross section ratios for mirror transitions evidences that these reactions cannot be described below 35–40 MeV simply as a direct two–nucleon pickup. The values for spin- and isospin-dependent terms in the effective interaction obtained from a distorted–wave Born–approximation analysis differ from those used in shell model calculations and in microscopic analyses of inelastic scattering. (auth)

18465 PION–NUCLEUS SCATTERING IN A CLUSTER MODEL. Yam, Y. Y. (Department of Physics, College of William and Mary, Williamsburg, Virginia 23185). Phys. Rev. C 11: No. 1, 73-81 (Jan 1975).

The forward amplitude for pion–nucleus scattering in the N^{*} region is studied using a Glauber formalism with a cluster model of the nucleus. It is found that the major features of the data for light nuclei (^{6}Li, ^{7}Li, ^{9}Be, ^{16}O) are resonably well reproduced by using a simple parametrization of the cluster structure. These results are in sharp contrast to predictions of a nucleon model at a comparable level of simplicity. We argue that a Glauber series representation of the amplitude is viable in a cluster model, but not reliable in a nucleon model, essentially because the interlocking effects of multiple scatterings and strong particle correlations inside the nucleus are easy to approximate in the former model and are difficult to account for in the latter model. Several modifications of the basic cluster model are considered and estimated to be small. More studies, experimental and theoretical, on angular distributions are urged. (auth)

Nuclear Properties and Reactions, $20 \leq A \leq 38$

Refer also to abstracts 17848, 17950, 18414, 18440, 18447, 18454, 18456, 18461, 18465, 18533, 18536, 18546, and 18547.

18466 (AECL-4841, p 11) ISOSPIN FORBIDDEN PARTICLE DECAY WIDTHS OF THE LOWEST T = 3/2 LEVEL OF ^{21}Ne. McDonald, A. B. (Atomic Energy of Canada Ltd., Chalk River, Ont.); Mak, H. B.; Evans, H. C.; Ewan, G. T. Jul 1974.

In Physics Division progress report, April 1–June 30, 1974.

18467 (AECL-4841, pp 67-68) KINETIC ENERGY CONTRIBUTION TO THE ^{20}Ne SPECTRUM. Amiot, P.; Harvey, M. Jul 1974.

In Physics Division progress report, April 1–June 30, 1974.

18468 (AED-CONF-74-042-007) THE EFFECT OF REACTION MECHANISMS ON DOUBLE DIFFERENTIAL CROSS SECTIONS AND TRANSITION MATRIX ELEMENTS. Hofmann, A. 1974. 9p. (In German). INIS.

From spring meeting of the expert committee on nuclear and high-energy physics of the Deutsche Physikalische Gesellschaft e. V.; Bochum, F. R. Germany (4 Mar 1974).

With figs. and tabs.

The work examines the question of whether one can gain additional information from double-differential effective cross sections and whether such cross sections are more responsive to model assumptions than to simple differential ones. Results are shown for (d,p) reactions on ^{24}Mg and ^{52}Cr at 10 MeV and for α-scattering at 15 MeV on ^{26}Mg. (GE)

18469 (BARC-768) ANNUAL REPORT OF THE NUCLEAR PHYSICS DIVISION, PERIOD ENDING DECEMBER 1973. Ramamurthy, V. S.; Rao, K. R. P. M. (eds.). (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). 1974. 242p. Dep. NTIS (US Sales Only) $15.25.

The nuclear physics program was centered around the 5.5-MeV van de Graaff accelerator at Trombay. Research in fission physics involved multiparameter studies of spontaneous and neutron-induced fission along with the associated radiations and the theoretical interpretations of the measured correlations. A growing research program exists in x-ray and neutron diffraction and neutron scattering studies of solids and liquids, and these techniques were exploited for the understanding of the geometrical structure of many biologically significant molecules, the magnetic structures of technologically important materials, and the dynamics of condensed media. Experiments with the Fast Critical Facility, PURNIMA, contributed to a general understanding of the neutron-multiplying properties of fast plutonium systems. Feature articles are included on the development of the semiconductor x-ray fluorescence spectrometer and the neutron radiography facility. Individual reports containing significant information are either abstracted or title listed separately. (RWR)

For abstracts or title listing of individual papers see: 15968, 16482, 16573, 16638, 16639, 16672–16674, 17007, 17196, 17678, 18470–18473, 18491–18493, 18607, 18608, 18617, 18618, 18789, and 19057.

18470 (BARC-768, pp 39–40) T = $^3/_2$ ANALOG RESONANCE IN ^{33}Cl THROUGH CAPTURE AND INELASTIC SCATTERING OF PROTONS. Eswaran, M. A.; Ragoowansi, N. L.; Chakrabarthy, D. R.; Oza, H. H. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18471 (BARC-768, pp 40–41) INVESTIGATION OF EXCITED STATES IN ^{36}Ar NEAR ANALOG REGION BY ALPHA CAPTURE REACTION. Eswaran, M. A.; Ragoowansi, N. L.; Oza, H. H. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18472 (BARC-768, pp 42–44) ELASTIC SCATTERING OF ALPHA PARTICLES BY ^{26}Mg. Kanetkar, L. J.; Gupta, S. K.; Kailas, S.; Kerekatte, S. S.; Mehta, M. K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18473 (BARC-768, pp 48–49) NEUTRON RESONANCE PARAMETERS FOR THE STATES OF ^{33}S. Balakrishnan, M.; Mehta, M. K.; Kailas, S.; Divatia, A. S. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18474 (ORO-2972-279) ANNUAL REPORT, 1974. Bishop, J. (ed.). (Texas Univ., Austin (USA). Center for Nuclear Studies). 1974. 313p. Dep. NTIS $18.75.

This report describes the basic research and the development of experimental techniques carried out during the period from December 1, 1973, to November 30, 1974. Most of the theoretical work is devoted to theoretical nuclear physics; the experimental research, on the other hand, falls into the categories of experimental nuclear physics, atomic physics, nuclear astrophysics, and research instrumentation. Lists of computer programs, publications, abstracts, invited lectures, degrees awarded, and personnel are also included. Articles containing significant amounts of information are title listed separately. (RWR)

For title listings of individual papers see: 18141–18143, 18437, 18438, 18475, 18476, 18499, and 18549.

18475 (ORO-2972-279, pp 5–9) ^{32}S(d,p)^{33}S TO NEUTRON RESONANCES. 1974.

In annual report, 1974.

18476 (ORO-2972-279, pp 10–17) STUDIES OF $l = 2$ j-DEPENDENCE FOR THE (d,p) REACTION. Hoffmann, G. W.; Coker, W. R.; Bishop, J.; Liljestrand, R.; Blanpied, G.; Ray, L.; Lynch, J. 1974.

In annual report, 1974.

18477 DETERMINATION OF THE SPIN AND THE PARITY OF THE 17.75 MeV-STATE IN ^{28}Si. Vasil'ev, S. S.; Dem'yanova, A. S.; Mikhaleva, T. N.; Chuprunov, D. L. (Moskovskij Gosudarstvennyj Univ. (USSR). Inst. Yadernoj Fiziki). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 769–770(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The resonances at proton energies of 6.40 MeV were observed as a function of the (p, α_1) reaction on ^{27}Al. Ternary angular correlations for these resonances were measured in the reaction plane at $\theta_p = 135°$. The experimental points in the limits of error lay well on the curve calculated by the angular correlation theory for the mechanism of the formation of bound nuclei with consideration of the spin-orbit interaction for the momentum values $l_p = 0$ and $j_p = {}^1/_2$ and $^3/_2$, $l_\alpha = 0$ and 2, which gives $I^\pi_{res} = 2^+$. For other possible values of the spin and parity of the resonances agreement of experiment with the calculated curve was not observed. (tr-auth)

18478 ELASTIC AND INELASTIC SCATTERING OF PROTONS BY ^{24}Mg AND ^{26}Mg NUCLEI AT 6 MeV. Gubin, V. B.; Kalacheva, Z. F.; Romanovskij, E. A.; Sirotinin, E. I.; Spasskaya, T. I.; Shishkin, K. S. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 868–872(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The role of resonance effects during the elastic and inelastic scattering of protons at 6 MeV by ^{24}Mg and ^{26}Mg was studied. As a result of the processing of the energy spectra of the protons, scattered by the target at an angle $\theta_{lab} = 60$ to 160°, the energy and angular dependences of the scattering cross sections were obtained. On the basis of an analysis conclusions were made on the differences of the resonance contributions in elastic and inelastic scattering of protons. In cases of elastic and inelastic scattering of the protons on ^{24}Mg separate levels were excited in the compound nucleus ^{25}Al, but during collisions of protons with ^{26}Mg, in addition to the excitation of the background level, excitation of analogous states in ^{27}Al occurred. (INIS)

18479 ^{39}K(p,d)^{38}K REACTION AT $E_p = 35$ MeV. Wildenthal, B.H.; Rice, J.A. (Cyclotron Laboratory and Department of Physics, Michigan State University, East Lansing, Michigan 48824); Preedom, B.M. Phys. Rev. C 10: No. 6, 2184-2196 (Dec 1974).

The ^{39}K(p,d)^{38}K reaction at $E_p = 35$ MeV has been used to study the properties of states in ^{38}K up to an excitation energy of 6 MeV. An experimental resolution of 10 keV (full width at half–maximum) made it possible to detect many heretofore unobserved states. Excitation energies of observed states are determined to an accuracy of 1–4 keV. Angular distributions were measured for many of the transitions, and for these states assignment of l_n values and extraction of spectroscopic factors are made. The results are compared to previous experiments and to current shell–model calculations. (auth)

18480 TOTAL CROSS SECTIONS FOR THE ^{19}F(^{13}C, ^{12}C)^{20}F AND ^{23}Na(^{13}C, ^{12}C)^{24}Na REACTIONS. Laumer, H.; Seaman, G.G. (Department of Physics, Kansas State University, Manhattan, Kansas 66506). Phys. Rev. C 10: No. 6, 2159-2165 (Dec 1974).

Total cross sections for the (^{13}C, ^{12}C) reaction on ^{19}F at laboratory energies of 9.0 to 25.0 MeV and on ^{23}Na at energies of 10.5 to 19.5 MeV were measured by detecting the γ rays from excited states and from the decay of the radioactive ground states. At energies well below the Coulomb barrier the cross sections are compared with a semiclassical distorted-wave Born-approximation calculation, and spectrosopic factors are extracted. (auth)

18481 NEUTRON RESONANCE SPECTROSCOPY: MAGNESIUM. Singh, U.N.; Liou, H.I.; Rainwater, J.; Hacken, G. (Columbia University, New York, New York 10027); Garg, J.B. Phys. Rev. C 10: No. 6, 2150-2152 (Dec 1974).

The total neutron cross sections vs energy to 500 keV, measured using high-purity samples of natural Mg, show four main strong levels plus a weak level at 498 keV. An R–matrix fit is mainly established by the four strong levels having (E_0, A, l, J, Γ_n) values (19.90, 25, 0, 2, 1.79 ± 0.18), (83.50, 24, 1, 3/2, 7.6 ± 0.5), (265.2, 24, 1, 1/2, 90 ± 5), and (426.3, 24, 1, 3/2, 23.2 ± 2.3), with E_0 and Γ_n in keV. Using a channel radius of 5 fm, we obtain a p strength function for ^{24}Mg, $10^4 S_1 = (10.5^{+11.8}_{-4.9})$ to 500 keV. (auth)

18482 NEUTRON RESONANCE SPECTROSCOPY: CHLORINE. Singh, U.N.; Liou, H.I.; Hacken, G.; Slagowitz, M.; Rahn, F.; Rainwater, J.; Makofske, W. (Columbia University, New York, New York 10027); Garg, J.B. Phys. Rev. C 10: No. 6, 2138-2142 (Dec 1974).

Results are presented of time-of-flight total σ vs E measurements for natural Cl to 400 keV. Resonance parameters were obtained for 35 resonances below 200 keV. Of these, 12 resonances were assigned to ^{35}Cl, 6 to ^{37}Cl, with 17 weak resonances for which isotope assignments could not be made. On the basis of our assignments as s or p resonances, $10^4 S_0 = (0.12^{+0.23}_{-0.07})$ for ^{35}Cl and $(0.59^{+0.66}_{-0.28})$ for ^{37}Cl. For ^{35}Cl, $10^4 S_1 = (0.77^{+0.53}_{-0.29})$ with no S_1 determination for ^{37}Cl. The anomalous behavior of σ vs E below ~1000 eV for natural Cl, along with previously established thermal cross sections, are fitted by assigning a bound resonance in ^{35}Cl at −130 eV, having $l = 0$, $J = 2$, $\Gamma^0_n = 0.725$ eV, and $\Gamma_\gamma = 0.378$ eV. (auth)

18483 IS THERE A SUPERBAND IN ^{20}Ne? Fortune, H.T.; Betts, R.R.; Middleton, R. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 10: No. 6, 2135-2137 (Dec 1974).

No evidence is found in the ^{12}C(^{12}C, α)^{20}Ne reaction for a 6^+ member of a "superband" predicted by Vogt to lie in the range E_x = 10–11 MeV. We suggest the 6^+ state at 12.14 MeV as the 6^+ member of the core–excited band built on the 7.20–MeV 0^+ state. (auth)

18484 EXCITATION OF M1 AND M2 STATES IN ^{22}Ne BY 180° ELECTRON SCATTERING. Maruyama, X.K.; Lindgren, R.A.; Bendel, W.L.; Jones, E.C. Jr.; Fagg, L.W. (Nuclear Sciences Division, Naval Research Laboratory, Washington, D. C. 20375). Phys. Rev. C 10: No. 6, 2257-2264 (Dec 1974).

States in ^{22}Ne have been studied by 180° inelastic electron scattering with incident energies of 37, 50, and 60 MeV. Prominent magnetic dipole and quadrupole states are observed below 13 MeV excitation energy. Reduced transition probabilities, transition radii, and spin and parity assignments are presented for these states and compared to shell model calculations. (auth)

18485 OPTICAL MODEL ANALYSIS OF ELASTIC SCATTERING OF DEUTERONS ON ^{28}Si AT 1.9 TO 2.5 MeV. Bondouk, I. I. (Atomic Energy Establishment, Cairo). Rev. Roum. Phys.; 19: No. 8, 847-850(1974).

The differential cross sections for the elastic scattering of deuterons by ^{28}Si were analyzed in terms of the optical model using surface absorption. Good fits were obtained with optical model potentials of real well depths in the region of 100 MeV. (auth)

18486 STRUCTURE OF ^{20}Ne: THE ^{19}F(^{3}He, *d*)^{20}Ne REACTION. Betts, R.R.; Fortune, H.T.; Middleton, R. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 11: No. 1, 19-28 (Jan 1975).

The ^{19}F(^{3}He, d)^{20}Ne reaction has been studied at a bombarding energy of 18 MeV. Levels were identified up to an excitation energy of 13.3 MeV in ^{20}Ne. Several new spin–parity and isospin assignments are made. A comparison of the experimental spectroscopic strengths with those predicted by the Nilsson, SU(3) and shell models shows reasonably good agreement. (auth)

18487 ^{29}Si(α, *n*)^{32}S REACTION FROM 2.15 TO 5.25 MeV BOMBARDING ENERGY. Balakrishnan, M.; Mehta, M.K.; Divatia, A.S.; Kailas, S. (Van de Graaff Laboratory, Nuclear Physics Division, Bhabha Atomic Research Centre, Bombay 400 085, India). Phys. Rev. C 11: No. 1, 54-63 (Jan 1975).

Levels in the compound nucleus ^{33}S have been investigated by measuring the reaction cross section for the reaction ^{29}Si(α, *n*)^{32}S for incident α energies from 2.15 to 5.25 MeV, mostly in steps of 2.5 keV, using a 4π–geometry neutron counter. One hundred and thirty–four resonances have been identified. The reciprocity theorem has been used to calculate the total cross section for the inverse reaction ^{32}S(*n*, α)^{29}Si. Total widths have been determined for 107 resonances, and partial widths Γ_α, Γ_n and corresponding reduced widths γ_α^2, γ_n^2 have been extracted for 19 cases where spin values are known. Statistical strength function analysis of the cross section under the excitation curve gave the averaged α particle strength function value as $\langle \bar{S}_\alpha \rangle = 0.067 \pm 0.012$ for this reaction. (auth)

18488 ALPHA PICKUP TO LOW–LYING LEVELS OF ^{42,44}Ca. Medsker, L.R.; Headley, S.C.; Fortune, H.T. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174); Duray, J.R. Phys. Rev. C 11: No. 1, 100-102 (Jan 1975).

The ^{46,48}Ti(*d*, ^{6}Li)^{42,44}Ca reactions to low–lying states have been studied at a bombarding energy of 28 MeV. Relative to the ground states, spectroscopic factors for the first excited 0^+ and 2^+ states are about 0.2. These results, and other work, indicate the need for components involving both 2 and 4 *sd*–shell holes for these nuclei. (auth)

18489 γ–RAY LINEAR POLARIZATION MEASUREMENTS FOLLOWING HEAVY–ION BOMBARDMENT OF 2*s*–1*d* SHELL NUCLEI. Olness, J.W.; Lumpkin, A.H.; Kolata, J.J.; Warburton, E.K. (Brookhaven National Laboratory, Upton, New York 11973); Kim, J.S.; Lee, Y.K. Phys. Rev. C 11: No. 1, 110-127 (Jan 1975).

As part of a program utilizing the fusion–evaporation reaction to study high–spin states in $A \simeq 40$ nuclei, linear polarization measurements were made on the γ rays emitted following fusion of the six projectile–target combinations: ^{14}N + ^{26}Mg, ^{18}O + ^{24}Mg, ^{18}O + ^{26}Mg, ^{18}O + ^{27}Al, ^{19}F + ^{27}Al, and ^{19}F + ^{28}Si. All beam energies were 40 MeV except the last, which was 45 MeV. The linear polarization of about 50 γ rays from the highly aligned states were measured in each experiment using a two–crystal Ge(Li) Compton polarimeter. The results are tabulated. As an example of the application of these results, the polarization data in conjunction with previous γ–γ coincidence and γ–ray angular distribution measurements suggest *E*2 character for the γ cascades between the ^{41}K levels at 4983, 4275, 2762, and 1294 keV, and thus support the spin–parity sequence $19/2^-$, $15/2^-$, $11/2^-$, and $7/2^-$ for these states. Applications to the spectroscopy of other levels in ^{41}K, ^{41}Ca, and ^{39}K are discussed. (auth)

18490 ENHANCED EXCITATION OF THE OUTGOING PARTICLE IN THE ^{27}Al(^{12}C,^{11}B)^{28}Si REACTION. Pougheon, F.; Roussel, P.; Détraz, C.; Rotbard, G. (Institut de Physique Nucléaire, Université de Paris–Sud, 91406–Orsay, France). Phys. Rev. C 11: No. 1, 287-289 (Jan 1975).

The semiclassical description of heavy–ion–induced transfer reactions is used to select a case in which ejectile excitation should be enhanced. The ground–state transition in the ^{27}Al(^{12}C,^{11}B)^{28}Si reaction is found to exhibit such an effect. (auth)

Nuclear Properties and Reactions, $39 \leq A \leq 58$

Refer also to abstracts 16633, 17848, 18414, 18430, 18440, 18455, 18468, 18479, 18489, 18522, 18546, 18547, and 18645.

18491 (BARC-768, pp 44-48) REACTION MECHANISM STUDY OF THE (p,n) REACTIONS IN ^{51}V AND ^{50}Ti BELOW 5.0 MeV. Kailas, S.; Mehta, M. K.; Gupta, S. K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18492 (BARC-768, pp 50-53) STUDY OF ^{50}Ti(p,nγ)^{50}V REACTION. Gupta, S. K.; Saini, S.; Kailas, S.; Kerekatte, S. S.; Kanetkar, L. J. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18493 (BARC-768, pp 55-56) LEVEL-SCHEME OF ^{50}V. Gupta, S. K.; Saini, S.; Kanetkar, L. J. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18494 (BNL-19287) OSCILLATIONS IN THE ANGULAR DISTRIBUTIONS OF HEAVY-ION TRANSFER REACTIONS. Garrett, J. D. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 27p. (CONF-741056-1). Dep. NTIS $4.50.

From symposium on classical and quantum mechanical aspects of heavy ion collisions; Heidelberg, F. R. Germany (2 Oct 1974).

Oscillations in the angular distributions are established as a general feature of heavy-ion induced, few-nucleon transfer reactions at incident energies sufficiently above the Coulomb barrier. For proper Q-matching with incident and exiting energies well above the Coulomb barrier, the angular position of the most forward maxima in the differential cross section is characteristic of the transferred angular momentum. The threshold for such oscillations is particularly sensitive to the absorptive potential near the nuclear surface requiring potentials that are strongly absorbing in the nuclear interior but nearly transparent at the surface. Evidence also is presented for an energy dependent surface absorption. Certain anomalous cases where the oscillating cross sections are predicted to be out of phase with the data are discussed. (auth)

18495 (FRNC-TH-488) SPECTROSCOPIC STUDY OF ^{41}Sc FROM ^{40}Ca(p,p)^{40}Ca, ^{40}Ca(d,n)^{40}Ca, AND ^{40}Ca(p,γ)^{41}Sc REACTIONS. Rabin, B. (Strasbourg-1 Univ., 67 (France)). 1973. 175p. (In French). Dep. NTIS (US Sales Only) $11.75.

Thesis.

The spin and parity of 14 levels of the ^{14}Sc nucleus were determined, nine of which are situated amongst the first levels. Spectroscopic information was obtained from studies of the elastic scattering of protons on ^{40}Ca, the ^{40}Ca(d,n)^{41}Sc* → p + ^{40}Ca sequential reaction, and the ^{40}Ca(p,γ)^{41}Sc radiative capture reaction. An original technique for automatically varying the energy of the particle beam was used to study the elastic scattering of protons by ^{40}Ca (1.3 to 5 MeV). The energy dispersion of the beam was reduced and thin targets were used. In this way, the well-defined forms of thirty-nine resonances (10 of which have widths of less than 0.5 keV) were determined, most of the results referring to backward scattering at 150 to 177 degree angles. Ten of these isolated resonances were fitted using theoretical excitation functions. The cross sections (one-level approximation) were integrated over the energy dispersion of the beam and over the target thickness for the case of narrow levels. In this way, the widths (Γ), orbital angular momentum (l), and total spin (J) were obtained for 8 ^{41}Sc levels. The spin values, J, corresponding to the 1st and 3rd ^{41}Sc levels were determined from neutron ($\theta = 0°$) –proton ($\theta\propto$) angular correlation measurements made for the 1729 keV and 2412 keV excited states of ^{41}Sc in ^{40}Ca(d,n)^{41}Sc* → p + ^{40}Ca. As for ^{40}Ca(d,n)^{41}Sc* → p + ^{40}Ca, angular distribution and plane of polarization measurements made for the γ radiation emitted in transitions from the 2882^-, 2969^-, 3182^-, and 3692-keV levels of ^{41}Sc to the ground state led to the determination of the spin and parity of these four levels. The predominant configurations of the levels studied are discussed in the framework of the shell model. A comparison is made between ^{41}Sc and the mirror nucleus, ^{41}Ca. (FR)

18496 (JINR-P4-8325) PAIR CORRELATIONS AND TWO-NUCLEON TRANSFER REACTIONS IN NUCLEI WITH A = 46 TO 64. Dzholos, R. V.; Kartavenko, V. G.; Semenov, V. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The experimental data on two-nucleon transfer cross sections are analyzed in the framework of the microscopic model of the pairing collective motion. The differential cross sections of the ^{46}Ca to ^{62}Ni(t,p) reactions are calculated. The influence of the anharmonical effects on the spectroscopic amplitudes and the two-neutron transfer cross sections is investigated. The data are also compared with the predictions of the rotational and vibrational models and with the shell-model calculations. (auth)

18497 (JUL–986-KP) HARTREE-FOCK CALCULATIONS WITH DENSITY-DEPENDENT EFFECTIVE INTERACTIONS: TEST OF CALCULATED GROUND STATE DATA BY ELASTIC E-SCATTERING AND X-RAY CASCADES OF MUONIC ATOMS. Galonska, J. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Inst. fuer Kernphysik; Muenster Univ. (F. R. Germany)). Jul 1973. 125p. (In German). INIS.

18 figs.; 18 tabs.; 84 refs.

Hartree–Fock (HF) calculations are performed with the two density-dependent effective nucleon–nucleon interactions of the type described by Ehlers and Moszkowski and by Vautherin and Brink. A common feature of both forces is that they yield a good description of the ground-state properties of doubly magic nuclei, in spite of their simplicity. Both rms radii and one-particle energies as well as total binding energies are equally well reproduced, which is impossible by means of HF calculations with density-independent interactions. This is not simply a result of the fit of the free parameters of the two forces to a few of the experimental data given in the study, which is shown by further comparisons with the results of elastic electron scattering by ^{40}Ca, ^{48}Ca and ^{208}Pb, and of measurements with muonic atoms (^{208}Pb); in these experiments, higher charge exchange moments could be tested in addition to the rms radii. (GE)

18498 (ORNL-tr-2800) PHOTOPRODUCTION OF CHARGED PIONS BY THE ^{40}Ca NUCLEUS AT A MAXIMUM BREMSSTRAHLUNG ENERGY OF 340 MeV. Grishaev, I. A.; Krinitsyn, A. N.; Lapin, N. I.; Nikiforov, V. I.; Pugachev, G. D.; Shramenko, B. I. Translated from Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 3, 445-450 (1973). 8p. Dep. NTIS \$4.00.

Differential cross sections of charged pion photoproduction on ^{40}Ca nucleus are measured at the bremsstrahlung maximal energy $E_0 = 340$ MeV. π^+- and π^--mesons with kinetic energies from 20 to 90 MeV were registered using photoemulsions under 60, 90, and 120° angles. The π^-/π^+ ratio for kinetic energies from 25 to 85 MeV are found to decrease from 1.58 ± 0.3 to 0.9 ± 0.24, from 1.69 to 0.88 ± 0.26 from 1.82 ± 0.71 to 0.81 ± 0.3, for the 60, 90 and 120° angles respectively. The experimental results are in agreement with volume production of charged mesons on nuclei. The equation for the calculation of the π^-/π^+ ratio is found. (auth)

18499 (ORO-2972-279, pp 18-22) ^{40}Ar(d,p)^{41}Ar REACTION. Riley, P. J.; Newsom, C.; Craig, W. 1974.

In annual report, 1974.

18500 COEXISTENCE OF THE SPHERICAL AND DEFORMED STATES IN ^{51}Cr NUCLEI. Peker, L. K. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 807-810(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The characteristics of the levels of ^{51}Cr excited in stripping reactions on the even-even ^{50}Cr nucleus and the odd-odd ^{50}V nucleus were examined. It was shown that in ^{51}Cr the spherical and deformed states coexist. (INIS)

18501 EFFECT OF THE ISOTOPE-INVARIANT PAIR CORRELATIONS ON THE MEAN-SQUARE NUCLEAR RADII. Afanas'ev, G. N.; Dzholos, R. V.; Kartavenko, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 730-733(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The effect of isotope-invariant pair correlations on the mean-square nuclear radii was studied. Calculations of the mean-square nuclear radius were made for isotopes of Cr, Fe, Ni, and Zn. It was shown that consideration of the pairing leads to an increase of the mean-square radius by 1 to 2% in comparison with the shell values and qualitatively accurately reflects the pattern of the charge mean-square radius according to the isotopes. The observed anomalies in the quantitative ratio of the pair correlation at different values of the pairing constant can not be explained. (tr-auth)

18502 STUDIES OF (α,d) REACTIONS ON N = 28 NUCLEI. I. ^{51}V(α,d)^{53}Cr. Kawa, J. I.; Okaka, K.; Yamagata, T. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap.; 36: No. 4, 929-936(May 1974).

Angular distributions of deuterons to 13 levels in ^{53}Cr were measured up to 3.72 MeV of excitation energy using 22-MeV alpha particles. The angular distributions are compared with the zero-range DWBA calculations employing the explicit wave functions for the ^{53}Cr states given by a shell model calculation. The ^{53}Cr states above $E_x = 1.28$ MeV which are only weakly excited by one-nucleon transfer reactions are found to be rather strongly excited. They are assigned as the states of which main configuration corresponds to the coupling of one neutron outside the N = 28 core with the $J^\pi \neq 0^+$ protons. An attempt is made to determine the absolute normalization constant for the (α,d) cross sections and the value $D_0^2 \sim 10^3$ MeV^2 fm^3 is obtained. (auth)

18503 STUDY ON THE SCATTERING AND POLARIZATION OF PROTONS BY Ca NUCLEI IN THE ENERGY RANGE FROM 5 TO 6 MeV. Gubin, V. B.; Gulamov, I. R.; Romanovskij, E. A.; Sirotinin, E. I.; Spasskaya, T. I.; Shishkin, K. S. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 863-867(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The energy and angular dependences of the elastic scattering cross section and the polarization of protons at 5 to 6 MeV by ^{40}Ca were measured by the thick-target method. The experimental results were compared with results of calculations made with the optical model. (INIS)

18504 ON THE DIFFRACTION INELASTIC SCATTERING OF INTERMEDIATE ENERGY PARTICLES BY NUCLEI. Berezhnoj, Yu. A.; Shlyakhov, N. A. (AN Ukrainskoj SSR, Kiev. Fiziko-Tekhnicheskij Inst.). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 734-740(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

On the basis of the diffraction model a method was proposed for the calculation of the differential cross section for elastic and inelastic scattering of particles on nuclei. The results of the calculation of the scattering of protons on ^{114}Cd ($E_p = 55$ MeV), ^{58}Ni ($E_p = 1040$ MeV), and ^{208}Pb ($E_p = 1040$ MeV, of ^{3}He on ^{56}Fe ($E_{^3He} = 33.5$ MeV), and of α particles on ^{58,60,62,64}Ni ($E_\alpha = 104$ MeV) were compared with experimental data. The diffraction model made it possible to obtain the same information on nuclei as the optical model and the distorted wave method. In the method proposed however there are no complex numerical calculations. (INIS)

18505 EXACT–FINITE–RANGE COUPLED–REACTION–CHANNEL CALCULATION APPLIED TO THE ANALYSIS OF REACTION ^{48}Ca(^{16}O, ^{15}C)^{49}Ti. Udagawa, T.; Tamura, T.; Low, K.S. (Center for Nuclear Studies, University of Texas, Austin, Texas 78712). Phys. Rev. Lett. 34: No. 1, 30-33 (6 Jan 1975).

Data for the exotic reaction ^{48}Ca(^{16}O, ^{15}C)^{49}Ti are shown to be explained satisfactorily in the picture of successive transfer reactions, with a calculation which treats the finite–range effect exactly. (auth)

18506 SHELL–MODEL CALCULATIONS FOR ^{51}Ti AND ^{52}V. Fu, C.C.; Rustgi, M.L. (Physics Department, State University of New York, Buffalo, New York 14214). Phys. Rev. C 10: No. 6, 2649-2651 (Dec 1974).

Employing ^{48}Ca as the core and the renormalized matrix elements of Kuo and Brown, the nuclear energy levels of ^{51}Ti and ^{52}V are calculated within the spherical shell–model framework. For ^{51}Ti all the 0f–1p configurations are included. but the ^{52}V nucleus is described within the $(0f_{7/2}, 1p_{3/2})_p^3 \times (1p_{3/2}, 0f_{5/2}, 1p_{1/2})_n^1$ configuration. The results are compared with experiment. (auth)

18507 REMOVAL OF AN APPARENT DISCREPANCY OF EXCITATION ENERGIES OF ^{55}Co. Goss, J.D.; Jolivette, P.L.; Rollefson, A.A.; Browne, C.P. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. C 10: No. 6, 2641-2642 (Dec 1974).

Excitation energies in ^{55}Co have been recalculated, eliminating a systematic error in values previously reported in a study of the ^{58}Ni(p,α)^{55}Co reaction. (auth)

18508 PROJECTED BAND–MIXED SPECTRA OF Fe AND Ni ISOTOPES. Parikh, J.K. (Department of Science and Technology, New Mehrauli Road, New Delhi–29, India). Phys. Rev. C 10: No. 6, 2568-2576 (Dec 1974).

The nuclear spectra of ^{54,56,58}Fe and ^{58,60,62}Ni are obtained by mixing various bands. The bands for each nucleus are obtained by considering the prolate and oblate Hartree–Fock solutions. The third band is obtained by considering two–particle–two–hole excitations on whichever is the lower solution of the above two. The states with definite angular momenta are projected and the orthogonalization is carried out to obtain the nuclear spectra. The Yukawa–Rosenfeld interaction (YR) and the Kuo–Brown interaction modified by McGrory et al. (KM) are used as the two–body interactions. The single-particle energies are varied for each nucleus to give a good fit. A comparison between the interactions shows that the KM interaction for the Fe isotopes and the YR interaction for the Ni isotopes give better results. In general, the agreement with the experimental spectra is very good. However, the second 2^+ state in ^{56,58}Fe and ^{60}Ni cannot be explained by this model, which considers only $K = 0$ bands. The high-spin states have also been obtained. The effects of the band mixing on the nuclear spectra are discussed in detail for each nucleus. (auth)

18509 COMPARISONS OF PREDICTIONS FROM TWO INTRANUCLEAR–CASCADE MODELS WITH MEASURED SECONDARY PROTON SPECTRA AT SEVERAL ANGLES FROM 62– AND 39–MeV PROTONS ON VARIOUS ELEMENTS. Bertini, H.W. (Neutron Physics Devision, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Harp, G.D.; Bertrand, F.E. Phys. Rev. C 10: No. 6, 2472-2482 (Dec 1974).

Detailed comparisons of correlated energy–angle proton spectra corresponding to continuum state transitions have been made between experimental data and two versions—Brookhaven National Laboratory (BNL) and Oak Ridge National Laboratory (ORNL) —of the intranuclear–cascade model for 62– and 39–MeV protons incident on carbon, iron, and bismuth. These energies were selected because detailed experimental data are available and because the energy limit of validity of the intranuclear–cascade approach could be examined. The calculated spectra are in good agreement ($\lesssim 30\%$) with the shapes and magnitudes of the measured integral spectra for the 62–MeV reactions. However, the comparisons of the spectra at angles $\lesssim 20°$ and $> 90°$ are poor. There is a much greater discrepancy in the correlated energy–angle data from reactions at 39 MeV. The BNL version, which contains the greater physical detail, tends to reduce the discrepancies in the spectral shape at small and large angles between the experimental data and the simpler intranuclear–cascade version (ORNL). Examples of these discrepancies are: a high estimated quasifree peak at small angles and a small scattering intensity at back angles. However, the BNL version reduces the particle yield for heavy targets so that the comparisons for the predicted absolute cross sections with the experimental data are often poor. The effects of reflection and refraction, which are included in the BNL version only, appear to be in the right direction to compensate for the discrepancies of the ORNL version, but some modification in the manner that this phenonenon is incorporated may be required to avoid the discrepancies in absolute cross sections. (auth)

18510 NEUTRON RESONANCE SPECTROSCOPY: CALCIUM. Singh, U.N.; Liou, H.I.; Rainwater, J.; Hacken, G.; Makofske, W. (Columbia University, New York, New York 10027); Garg, J.B. Phys. Rev. C 10: No. 6, 2143-2146 (Dec 1974).

Results are presented to 550 keV of high-resolution time-of-flight neutron total cross section measurements using various sample thicknesses of natural calcium. An R–matrix analysis was made to fit the results for the nine strong s levels in ^{40}Ca above 100 keV. A transmission area analysis was made for the 22 weaker observed levels which are also mainly due to ^{40}Ca, but have $l > 0$. We obtain $10^4S_0 = (2.97^{+1.95}_{-1.05})$ for ^{40}Ca. (auth)

18511 FERMI BETA DECAY, A > 40: THE HALF–LIVES OF ^{46}V, ^{50}Mn, AND ^{54}Co. Hardy, J.C.; Andrews, H.R.; Geiger, J.S.; Graham, R.L.; Macdonald, J.A.; Schmeing, H. (Atomic Energy of Canada Limited, Physics Division, Chalk River Nuclear Laboratories, Chalk River, Ontario, Canada K0J 1J0). Phys. Rev. Lett. 33: No. 27, 1647-1649 (30 Dec 1974).

Half–lives for ^{46}V, ^{50}Mn, and ^{54}Co have been measured to be 423.4 ± 2.0, 284.0 ± 0.4 and 193.4 ± 0.4 msec, respectively. The ^{50}Mn result is significantly different from the previously accepted value, and brings the ft value for the decay of ^{50}Mn into agreement with all other accurately known $0^+ \rightarrow 0^+$ superallowed decays. These new data are in complete agreement with the predictions of conserved vector current theory. (auth)

18512 MEASUREMENT OF THE REACTION ^{48}Ca(^{16}O, ^{15}C)^{49}Ti. Kovar, D.G.; Henning, W.; Zeidman, B.; Eisen, Y.; Fortune, H.T. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. Lett. 33: No. 27, 1611-1614 (30 Dec 1974).

The reaction ^{48}Ca(^{16}O, ^{15}C)^{49}Ti, which involves the transfer of two units of charge and only a single unit of mass, has been studied at 56 MeV. The magnitude of the forward–peaked angular distributions ($d\sigma/d\Omega \simeq 25$ μb/sr) is comparable to that observed for most of the few–nucleon transfers measured concurrently. The experimental results seem to imply that, in general, it may not be possible to ignore the contributions to cross sections originating from the more complex transfer processes. (auth)

18513 NUCLEAR SPECTROSCOPY WITH LITHIUM BEAMS. II. HIGH–SPIN STATES IN ^{52}Cr, ^{54}Mn, ^{54}Fe, AND ^{56}Fe. Poletti, A.R. (University of Auckland, Auckland, New Zealand); Brown, B.A.; Fossan, D.B.; Warburton, E.K. Phys. Rev. C 10: No. 6, 2329-2339 (Dec 1974).

The nuclei ^{52}Cr, ^{54}Mn, and ^{56}Fe have been investigated using ^{7}Li bombardment of ^{51}V at about 25 MeV bombarding energy. Further information has been obtained on the nuclei ^{54}Mn and ^{54}Fe from the ^{6}Li bombardment of ^{51}V at the same energy. Experimental methods used included recoil distance lifetime measurements (RDM), $\gamma-\gamma$ coincidence measurements, angular distribution measurements, and Doppler shift attenuation lifetime measurements (DSAM) on γ rays from high-spin states in the various nuclei. Mean lifetimes determined by RDM were as follows: in ^{52}Cr, 3114–keV level ($\tau = 60.0 \pm 2.6$ psec); in ^{54}Mn, 156–keV level ($\tau = 278^{+40}_{-120}$ psec); 368-keV (10.4 ± 1.6 psec); 1073-keV (292 ± 50 psec); in ^{56}Fe, 847–keV level ($\tau = 7.9 \pm 1.2$ psec). Tentative spin assignments were made as follows: in ^{52}Cr, 4751–keV level, $J = (8)$ (this state can be identified with the seniority 4, $J^\pi = 8^+$ state predicted in this region); in ^{54}Mn, 1073–keV level $J = (6)$; in ^{56}Fe, 3389–keV level $J = (6)$. Decay schemes observed in these nuclei are presented. Lifetimes (or limits) were also established from DSAM measurements for a number of other levels in these nuclei. Recent shell model calculations for these nuclei are discussed. (auth)

18514 NUCLEAR SPECTROSCOPY WITH LITHIUM BEAMS. I. HIGH–SPIN STATES IN ^{55}Fe, ^{55}Mn, AND ^{53}Cr. Poletti, A.R. (University of Auckland, Auckland, New Zealand); Brown, B.A.; Fossan, D.B.; Warburton, E.K. Phys. Rev. C 10: No. 6, 2312-2328 (Dec 1974).

The ^{7}Li bombardment of ^{51}V has been used in conjunction with recoil distance lifetime (RDM), $\gamma-\gamma$ coincidence, angular distribution, and Doppler shift attenuation lifetime (DSAM) measurements to gain information on the properties of high-spin states in the nuclei ^{55}Fe, ^{55}Mn, and ^{53}Cr. Mean lifetimes (τ) determined by RDM were as follows —in ^{55}Fe: 1409–keV level ($\tau = 57.8 \pm 3.5$ psec), 2813 (14.5 ± 3.1 psec), 5099 (32.3 ± 1.1 psec); in ^{55}Mn: 126–keV level ($\tau = 382 \pm 16$ psec); in ^{53}Cr: 2173–keV level ($\tau = 47 \pm 15$ psec); 3084 ($\tau = 43 \pm 15$ psec). Tentative spin assignments were made as follows—in ^{55}Fe: 5099–keV level $J = (19/2)$, 6528 $J = (21/2)$; in ^{55}Mn: 3056–keV level $J = (15/2)$. Lifetimes (or limits) were also established from DSAM measurements for a number of other levels in the above nuclei. The results are compared to shell model calculations. (auth)

18515 CHARGED PARTICLE Q VALUES FOR REACTIONS ON C, Cr, Fe, Co, AND Ni. Jolivette, P.L.; Goss, J.D.; Marolt, G.L.; Rollefson, A.A.; Browne, C.P. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. C 10: No. 6, 2449-2459 (Dec 1974).

Q values were measured for 27 reactions on targets of ^{12}C, ^{54}Cr, ^{54,56}Fe, ^{59}Co, and ^{58,60,62,64}Ni with resulting uncertainties of 0.7 to 3.2 keV. Care was taken to define sources of error. A χ^2 test on an interconnected set of 19 measurements indicates internal consistency and a comparison of eight (d,p) Q values with (n,γ) numbers shows excellent agreement. A mass evaluation was performed on a truncated region centered on Co. The results indicate that the 1971 values for the masses of ^{55}Cr and ^{55}Co are in error. The uncertainties of the masses of ^{53}Fe and ^{61}Co are greatly reduced. The question of the ^{57}Fe mass raised in The 1971 Atomic Mass Evaluation is not entirely resolved; consequently, the absolute values of some masses in this region are still uncertain to about 5 keV, although the Q values are improved. (auth)

18516 PROTON–γ ANGULAR CORRELATIONS IN THE REACTION ^{52}Cr(d, pγ)^{53}Cr. Eyrich, W.; Schneider, S.; Hofmann, A.; Scheib, U.; Vogler, F. (Physikalisches Institut III der Universität Erlangen–Nürnberg, 8520 Erlangen, Germany). Phys. Rev. C 10: No. 6, 2512-2522 (Dec 1974).

The reaction ^{52}Cr(d, pγ)^{53}Cr has been studied at a deuteron energy of 10 MeV up to an excitation energy in ^{53}Cr of about 5 MeV. The photons have been detected by use of a multidetector arrangement consisting of 8–11 silicon surface–barrier detectors. Particle–γ coincidence measurements have been performed with a Ge(Li) detector in and out of the reaction plane. Absolute double differential cross sections have been measured for particle angles between 20 and 160 ° for several transitions with l transfers of 1,2,3, and 4. From differential and double differential cross sections the experimental particle–γ angular correlation functions as a function of the particle angle have been extracted. The differential cross sections and the angular correlation functions have been analyzed with distorted–wave Born approximation. It turned out that deuteron potentials giving four half wave lengths of the wave function inside the potential well yield the best agreement with both the differential cross sections and the angular correlation functions. The influence of the spin-orbit potential on the angular correlation was found to be less. (auth)

18517 LEVEL DENSITY AND SPIN CUTOFF PARAMETERS FROM CONTINUUM (p, n) AND (α, n) SPECTRA. Grimes, S.M.; Anderson, J.D.; McClure, J.W.; Pohl, B.A.; Wong, C. (Lawrence Livermore Laboratory, Livermore, California 94550). Phys. Rev. C 10: No. 6, 2373-2386 (Dec 1974).

Neutron spectra produced by (p,n) reactions on ^{48}Ti, ^{49}Ti, ^{55}Mn, ^{58}Fe, and ^{63}Cu and (α,n) reactions on ^{45}Sc, ^{49}Ti, ^{51}V, ^{52}Cr, ^{58}Fe,

^{59}Co, and ^{60}Ni have been measured at four bombarding energies. The component of the spectra corresponding to equilibrium (evaporation) processes was identified from the angular and bombarding energy dependence of the continuum cross sections. Level density parameters, a, were deduced from the shape of the equilibrium emission spectra, and spin cutoff parameters, σ, were obtained from the anisotropy of the (α,n) angular distributions. Theoretical values for a and σ were obtained from a thermodynamic calculation with realistic single-particle levels; these agreed well with the measured values. In particular, the mass number A dependence of σ was reproduced by the calculation and results from the variation with A of angular momentum values of single-particle levels near the Fermi level. (auth)

18518 CHANGE IN THE SHAPE OF THE ^{40}Ar(p,p$_1\gamma$) ANGULAR CORRELATION DUE TO THE NEUTRON CHANNELS. Berinde, A.; Dumitru, R. O.; Neamu, I.; Scintei, N.; Teodorescu, C. M.; Zoran, V. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 6, 649-652(1974).

The ^{40}Ar(p,p$_1\gamma$) coplanar angular correlation was measured at $E_p = 3.74$ MeV, in a minimum of the excitation function, where the effects of the IAR are minimized. The experimental results confirm the change in the shape of the angular correlation function predicted by the statistical model when including the neutron channels. (auth)

18519 CONSISTENCY OF THE RECOIL–DISTANCE METHOD AND THE DOPPLER–SHIFT ATTENUATION METHOD FOR LIFETIME MEASUREMENTS USING TITANIUM AS THE SLOWING–DOWN ENVIRONMENT. Haas, B.; Chevallier, J.; Schulz, N.; Styczen, J.; Toulemonde, M. (Centre de Recherches Nucléaires, Laboratoire de Physique du Noyau et de Physique des Particules, 67037 Strasbourg, Cedex, France). Phys. Rev. C 11: No. 1, 280-281 (Jan 1975).

A coincidence recoil–distance Doppler–shift method has been used to obtain lifetimes for the 748 keV, $3/2^+$, 7.7 ± 0.9 ps and 1022 keV, $11/2^-$, 4.5 ± 1.3 ps levels in ^{49}V. A comparison with lifetime values determined by the Doppler–shift attenuation method shows good agreement. (auth)

18520 QUADRUPOLE VARIATION OF PROJECTED SPECTRA OF EVEN Ti ISOTOPES. Chandra, H.; Lichtner, P. (Institut für Kernphysik, Universität Mainz, Mainz, West Germany). Phys. Rev. C 11: No. 1, 228-236 (Jan 1975).

In the present work we study the dependence of projected good J states on the quadrupole moment. In order to achieve this, the quadrupole–moment–dependent generalized deformed BCS (DBCS) wave functions have been computed after minimizing the constrained Hamiltonian $H_q = H - \lambda N - \mu Q$. The calculation assumes the existence of a ^{40}Ca spherical core. The two-body residual interaction between the valence nucleons is determined by using the ^{42}Sc spectrum for the $T = 0$ force and the ^{49}Ca spectrum for the $T = 1$ force. The result of the calculation shows that the projected spectra in general cannot be described by a single DBCS wave function obtained as a result of minimizing the Hamiltonian without a quadrupole constraint. (auth)

18521 EVIDENCE FOR PROLATE DEFORMATION OF ^{56}Fe FROM 104-MeVα-PARTICLE SCATTERING. Gils, H. J.; Rebel, H.; Ciocanel, A. (Kernforschungszentrum, Karlsruhe, Ger.). Rev. Roum. Phys.; 19: No. 7, 761-776(1974).

Differential cross section for elastic and inelastic scattering of 104 MeV α-particles from ^{56}Fe were measured. The experimental data were analyzed in terms of coupled channels on the basis of a folding model using a deformed nucleon density distribution. The analysis results in prolate deformation of ^{56}Fe with an intrinsic mass quadrupole moment $Q_0 = +101 \pm 3$ efm^2 and with a rms-radius of the nuclear matter distribution $\langle r^2\rangle^{1/2} = 3.79 \pm 0.07$ fm. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 17848, 18496, 18501, 18504, 18508, 18515, 18517, 18546, 18547, 18596, 18648, and 18659.

18522 (BNL-19332) FOLDED POTENTIALS FOR THE DESCRIPTION OF HEAVY ION ELASTIC SCATTERING AND TRANSFER REACTIONS. Dover C. B.; Vary, J. P. (Brookhaven National Lab., Upton, N. Y. (USA)). Sep 1974. 14p. (CONF-741056-3). Dep. NTIS $4.00.

From symposium on classical and quantum mechanical aspects of heavy ion collisions; Heidelberg, F. R. Germany (2 Oct 1974).

A simple model is presented for the heavy ion optical potential based on the convolution of target and projectile densities with a suitably chosen nucleon-nucleon effective interaction. This model is shown to be appropriate for a number of low energy peripheral processes, such as elastic scattering and one- and two-particle transfer reactions. Application of the method to cluster states in light nuclei and relativistic heavy ion interactions is also considered. (auth)

18523 (JINR-P15-8201) GAMMA DECAY OF $p_{1/2}$ ANALOG RESONANCE IN ^{61}Cu. Kraft, O. E.; Naumov, Yu. V.; Sizov, I. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 20p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.00.

Gamma spectra from resonance decay in the reaction ^{60}Ni (p,γ)^{61}Cu at proton energies E_p = 1588, 1599, 1605, and 1620 keV were measured. These resonances are identified as the components of a fine structure of $p_{1/2}$ analog state. The population intensities are obtained for the ^{61}Cu states of 3 MeV excitation energy. The de-excitation scheme of these states is constructed. (3 figures, 2 tables) (auth)

18524 POSITIVE PARITY LEVELS OF HIGH ANGULAR MOMENTUM IN ^{69,71,73}Ge. Forssten, K.; Hasselgren, A.; Monseu, P; Nilsson, A.; Sawa, Z. P. (Research Inst. for Physics, Stockholm). Phys. Scr.; 10: No. 1-2, 51-64(Jul 1974).

Results of an attempt to establish in ^{69,71,73}Ge the low lying states of the presumed $1g_{9/2} \otimes$ core configuration are reported. The excited states in these nuclei were formed in the ^{66,68,70}Zn (α,n) compound reactions mainly at 14.2 MeV incident energy. Properties of the states were assigned from investigations of the prompt γ-ray transitions. Measuring γ-γ coincidences, yield functions, angular distributions (and in a few cases also linear polarization) of γ-rays evidences were found for states in ^{69}Ge: 1 350.4 keV $11/2^+$, 1 407.0 keV $13/2^+$, 2 017.9 keV $11/2^+$ or $13/2^+$, 2 119.2 keV $9/2^+$, $11/2$ or $13/2^+$, 3 075.5 keV $13/2^+$ or $15/2^+$, (and tentatively: 2 474.8 keV $11/2^+$ or $13/2^+$, and 2 754.6 keV $13/2^+$ or $15/2^+$). ^{71}Ge: 589.7 keV $7/2^+$, 1 037.8 keV ($7/2$ or $9/2$), 1 172.6 keV $13/2^+$, 1 192.3 keV $11/2^+$, 1 205.2 keV ($5/2^+$), 1 477.0 keV $11/2^+$, 1 559.3 keV, 1 566 keV, 1 959.7 keV $11/2^+$ or $13/2^+$, 2 299.2 keV $17/2^+$, 2 314.2 keV $15/2^+$ (and tentatively 1 697.8 keV). ^{73}Ge: 659.0 keV $9/2^+$, 825.8 keV $13/2^+$, 868.1 keV $11/2^+$, 1 610. 3 keV $9/2^+$ or $13/2^+$, 1 871.6 keV $17/2^+$. (auth)

18525 NUCLEAR DATA SHEETS FOR A = 63. Auble, R. L. (Oak Ridge National Lab., TN). Nucl. Data Sheets; 14: No. 2, 119-153(Feb 1975).

Nuclear structure data for A = 63 nuclei available through August 1974 are compiled, and adopted level and gamma-ray properties are presented. Where no additional data have been reported since the previous compilation (H. Verheul, Nuclear Data B2-3-31, 1967), only the values adopted in the latter are given. The compilation consists of three parts. The first gives a pictorial presentation of the bulk of the data, adopted decay schemes, and adopted level properties. The second, Summary Sheets, includes the adopted values with brief discussions of their origins and problems encountered in their derivation. The third, Data Sheets, includes tabulated data and references used in deriving the adopted level properties (except ^{63}Co for which all data are included on the Summary Sheet). This section also contains the adopted energies, intensities, and normalization factors for the ^{63}Zn and ^{63}Ga decay schemes. Similar data for ^{63}Co decay are given in the Summary Sheets. (auth)

18526 NUCLEAR DATA SHEETS FOR A = 68. Lewis, M. B. (Oak Ridge National Lab., TN). Nucl. Data Sheets; 14: No. 2, 155-190(Feb 1975).

Level schemes, spin and parity assignments, and decay properties are presented for all nuclei with mass number A = 68. Experimental data and adopted values are given along with conclusions as to the spin and parity assignments. The presentation of the nuclear properties is given in the light of the data and current theoretical ideas. The compilers have attempted to bring out some inconsistencies in the data and resolve discrepancies when possible. Deficiencies in the data include reaction data of the type ^{69}Ga(d,^{3}He) and ^{69}Ga(p,d). In addition, the data reported on ^{68}Se decay appear to be very uncertain. Level schemes for each of the A = 68 nuclei are presented first. Then for each nucleus is presented a summary of level properties and gamma or transition rate properties. Finally, the data and references are given for each nucleus. Adopted level and decay properties are based on data received before April 1974. (auth)

18527 DECAY OF ^{89}Nb. Votsilka, I.; Zibert, Kh.-U.; Kratsik, B.; Liptak, Ya.; Novgorodov, A. F.; Ortlepp, Kh.-G.; Toshev, M.; Khabenikht, V. (Joint Inst. for Nuclear Research, Dubna (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 672-680(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The positron spectra, γ-γ coincidences, and γ radiation of ^{89}Nb were studied by means of Si(Li) and Ge(Li) semiconductor detectors. Twenty-five previously unknown γ transitions were detected. In the level scheme of ^{89}Zr 10 new states were introduced at 2132, 2388.6, 2730, 3141.9, 3531, 3534, 3907, 3931, and 3948 keV. The limiting energy of the positrons was determined. The value of the lg ft β^+ decay was calculated and the structure of the levels of ^{89}Zr were discussed. (tr-auth)

18528 TWO-PARTICLE STATES IN ^{88}Zr EXCITED IN THE DECAY OF ^{88}Nb. Bayar, B.; Votsikla, I.; Gosior, M.; Zajtseva, N. G.; Kratsik, B.; Kuznetsov, V. V.; Liptak, Ya.; Lazurej, G. I.; Novgorodov, A. F.; Ortlepp, Kh.-G.; Toshev, M.; Khabenikht, V. (Joint Inst. for Nuclear Research, Dubna (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 666-671(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The γ spectra, γ-γ coincidences, and conversion electrons of ^{88}Nb were studied. Thirty-three γ transitions were detected. The multipolarities of the γ transitions at 76.7 and 271.4 keV were determined. A scheme for the excited levels of ^{88}Zr was discussed. (tr-auth)

18529 3^+ STATES IN EVEN-EVEN SOFT INTERMEDIATE NUCLEI. Sakai, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 758-768(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The 3^+ states were studied in two regions of soft or quasi-deformed nuclei by the method of proton beam spectroscopy. The two regions were the Kr region and the Xe–Ba region. New data on the nuclei ^{74}Se, ^{78,80}Kr, ^{84}Sr, and ^{118,120}Te were reported. For determination of the nature of the γ radiation emitted by the excited nuclei, the excitation function and the angular distribution of the γ radiation and the electron conversion spectra were measured. It was shown that quasi γ bands are more natural than the vibration model and explain the system of low lying levels of soft nuclei. The distribution of the 3^+ states in the system of levels strongly depends on the nuclear properties in the framework of the Davydov-Chaban model. (INIS)

18530 UNUSUAL BACK–ANGLE SCATTERING AND THE SIGNIFICANCE OF COUPLED CHANNELS IN THE ^{60}Ni(α, α') REACTION AT E_α = 40 MeV. Lewis, M.B.; Fulmer, C.B.; Hensley, D.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Foster, C.C.; O'Fallon, N.M.; Gronemeyer, S.A.; Eidson, W.W. Phys. Rev. C 10: No. 6, 2441-2448 (Dec 1974).

Cross sections were measured for elastic and inelastic scattering of 40.1–MeV α particles from ^{60}Ni over the range $\theta = 153-189$ °. The 180 ° cross section for inelastic scattering from the 2^+ excited state at 2.16 MeV was found to be more than an order of magnitude larger than that for the first excited 2^+ state at 1.33 MeV and nearly an order of magnitude larger than that for the elastic scattering. The phase of the angular distribution for the 2.16–MeV level is opposite to that of the 1.33–MeV level, but is the same as the elastic scattering. The data are compared with predictions of compound nucleus and coupled–channel reaction theory. While the compound nucleus reaction mechanism does not account qualitatively for these data, the coupled–channel approach is much more successful and indicates that the absorption term in the optical model potential is determined in a very sensitive way by the back–angle elastic and inelastic scattering. (auth)

18531 17.2–MeV PROTON INELASTIC SCATTERING FROM LOW–LYING UNNATURAL–PARITY STATES IN ^{88}Sr. Cecil, F.E.; Chestnut, R.P.; McGrath, R.L. (Department of Physics, State University of New York, Stony Brook, New York 11974). Phys. Rev. C 10: No. 6, 2425-2433 (Dec 1974).

The differential cross sections to the 1^+ (3.487–MeV) and 3^+ (3.635–MeV) levels in ^{88}Sr have been measured between laboratory angles of 20° and 110° in the inelastic scattering of 17.2–MeV protons. The measured cross sections are reasonably well predicted by distorted–wave Born–approximation calculations assuming realistic interactions and shell model wave functions spanning a large basis space. It is found that the calculated cross sections are dominated by the components in the wave functions involving the valence nucleons and that the core polarization is relatively unimportant. (auth)

18532 ELASTIC AND INELASTIC SCATTERING OF 12.0–MeV PROTONS FROM ^{84,86}Kr. Arora, B.K.; Olsen, D.K.; Riley, P.J.; Browne, C.P. (Center for Nuclear Studies, The University of Texas, Austin, Texas 78712). Phys. Rev. C 10: No. 6, 2301-2311 (Dec 1974).

Differential cross sections for elastic and inelastic scattering of 12.0–MeV protons from ^{84}Kr and ^{86}Kr have been measured. Optical–model parameters obtained from the elastic cross sections were used in distorted–wave–Born–approximation and coupled–channel calculations in order to determine the spin, parities, and deformation parameters of excited states. The deformation parameters found are β_2 = 0.128 and 0.108 for the first 2^+ states in ^{84}Kr and ^{86}Kr, respectively, and are β_3 = 0.158 and 0.145, respectively, for the first 3^- states. Most of the scattering strength to the "two–phonon" states proceeds through their one–phonon components. The spins of several higher excited states are suggested. (auth)

18533 SEMICLASSICAL MODEL FOR PION PRODUCTION BY NEUTRONS ON NUCLEI. Sparrow, D.A.; Sternheim, M.M. (Department of Physics & Astronomy, University of Massachusetts, Amherst, Massachusetts 01002); Silbar, R.R. Phys. Rev. C 10: No. 6, 2215-2220 (Dec 1974).

The semiclassical model for pion production by protons has been extended to neutron production. Calculations of the production by both neutrons and protons incident upon Al, Cu, and Pb agree well with experiment. The pion absorption cross sections in nuclear matter deduced from each of the six experiments are reasonably consistent with one another. (auth)

18534 STUDY OF THE ^{84}Kr(^{3}He,d)^{85}Rb REACTION. Medsker, L.R.; Bishop, J.N.; Headley, S.C.; Fortune, H.T. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 10: No. 6, 2117-2124 (Dec 1974).

The ^{84}Kr(^{3}He,d)^{85}Rb reaction has been studied at a bombarding energy of 18 MeV. The isotopically enriched ^{84}Kr target was contained in a gas cell with no entrance window. Excitation energies and angular distributions were obtained for 58 levels below E_x = 6.2 MeV in ^{85}Rb. A distorted–wave analysis was used to determine l values and spectroscopic strengths. The results are compared with previous data from transfer reactions and radioactive decay. (auth)

18535 ANALOG RESONANCES AND POSSIBLE $T_>$ MIXING IN ^{77}Br. Gray, J.W.; Legg, J.C. (Kansas State University, Manhattan, Kansas 66506). Phys. Rev. C 10: No. 6, 2577-2583 (Dec 1974).

The locations and widths of several analog resonances in ^{77}Br have been measured. Comparison of resonance spectroscopic factors to stripping spectroscopic factors show poor agreement, but spectroscopic factor ratios for states of the same spin and parity show good agreement except for the s–wave resonances. It is suggested that this disagreement may be explained by a mechanism of $T_>$ mixing between $1/2^+$ resonances. (auth)

18536 STUDY ON MULTIPLICITY DEPENDENCE OF SECONDARY PARTICLES ON THE ATOMIC NUMBER OF A TARGET AND ON THE BOMBARDING PARTICLE ENERGY. Antanelishvili, M. I.; Berdzenishvili, O. L.; Vervetskij, Yu. G.; Garsevanishvili, L. P.; Gromov, Yu. A.; Lomtadze, T. A.; Kotlyarevskij, D. M.; Matsaberidze, V. F.; Struchalina, A. V.; Chikovani, L. D.; Tsomaya, P. V.; Shtemanetyan, G. Z. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 5, 915-917(May 1974). (In Russian).

From All-Union conference on cosmic ray physics; Kharkov, USSR (25 Sep 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

An experimental study was made of the dependence of the multiplicity of secondary particles on the atomic number of the target nucleus and on the energy of the incident particle. Three hundred events on polyethylene targets, 230 on aluminum targets, and 280 on Cu targets were selected for analysis. The energies of the events selected were arranged in a wide interval from 50 to 3000 GeV. (tr-INIS)

18537 MECHANISM FOR THE RADIATION CAPTURE OF THERMAL NEUTRONS BY THE NUCLEI ^{60}Ni, ^{62}Ni, ^{64}Ni, ^{64}Zn, ^{66}Zn, ^{68}Zn, ^{70}Ge, ^{72}Ge, ^{74}Ge, AND ^{74}Se, ^{76}Se, ^{78}Se, AND ^{80}Se. Rudak, E. A.; Khil'manovich, A. M. (Inst. of Physics, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 5, 116-120(1974). (In Russian).

Within the framework of an intermediate approximation of a generalized model with dipole and quadrupole terms being taken into account in the interaction hamiltonian of the valence neutron with the core nucleus, calculations are made on the spectra of the lower levels and the wave functions of odd isotopes of Ni, Zn, Ge and Se. The wave functions are used to estimate the intensities of gamma rays of the first cascade which accompany capture of thermal neutrons by even isotopes of these elements. 12 refs. (tr-SJR).

18538 INFERRING THE NONSTATISTICAL ERRORS FROM THE LEAST-SQUARES FIT TO THE ANGULAR DISTRIBUTION DATA. Berinde, A.; Deberth, C.; Dumitru, R. O.; Neamu, I.; Scintei, N.; Teodorescu, C. M.; Zoran, V. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 6, 643-647 (1974).

The angular distributions of the gamma transitions measured in a ^{65}Cu(p,nγ)^{65}Zn experiment were analyzed, a special care being paid to the statistical interpretation of the Legendre polynomial fit to the data. It is shown that by comparing the distribution of the residual variances with a chi-squared distribution, an educated guess about the nonstatistical errors can be made. (auth)

18539 ENERGY DEPENDENCE OF ISOSPIN MIXING MATRIX ELEMENTS. Grimes, S.M. (Lawrence Livermore Laboratory, Livermore, California 94550). Phys. Rev. C 11: No. 1, 253-254 (Jan 1975).

Recently published values for the isospin mixing width at energies of 17 to 22 MeV in the nucleus ^{69}Ga are used to infer values for the isospin mixing matrix elements. It is found that these are much smaller in magnitude than those deduced at much lower energies from β decay measurements. (auth)

18540 POPULATION OF ANALOGS OF EXCITED STATES IN ^{63}Cu(*p*, *n*) AT 16, 19, AND 22 MeV. Wong, C.; Brown, V.R.; Anderson, J.D.; Davis, J.C.; Grimes, S.M.; Poppe, C.H. (Lawrence Livermore Laboratory, Livermore, California 94550); Madsen, V.A. Phys. Rev. C 11: No. 1, 137-144 (Jan 1975).

The ^{63}Cu(*p*, *n*) analog and excited analog differential cross sections have been measured at bombarding energies of 16, 19, and 22 MeV. Analogs of excited states populated by the (*p*, *n*) reaction in medium-mass odd—*A* nuclei have not been previously reported.
Coupled—channel calculations for the (*p*, *n*) reaction to the $5/2^-$ and $7/2^-$ excited analog states give differential cross sections at 19 and 22 MeV in excellent agreement with measurements. At 16 MeV, the measured $5/2^-$, $7/2^-$, and $1/2^-$ cross sections are higher than calculations at the middle angles, perhaps reflecting the contribution from preequilibrium processes. At 16 and 19 MeV the $1/2^-$ angular distribution shapes suggest some spin—flip contribution. The calculated cross section for the $1/2^-$ state is too high at 22 MeV. As in even—*A* nuclei a two-step mechanism is mainly responsible for the population of excited analog states in ^{63}Cu(*p*, *n*). (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 18245, 18438, 18504, 18529, 18596, 18597, and 18609.

18541 (AED-CONF-74-042-015) STUDY OF NEUTRON-RICH ISOTOPES IN THE RANGE A APPROXIMATELY 100 WITH THE JOSEF SEPARATOR. Borgs, J. W.; Grueter, J. W.; Lawin, H.; Rajagopalan, M.; Rashid, K.; Sadler, G.; Sistemich, K. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Inst. fuer Kernphysik). 1974. 5p. (In German). INIS.

From spring meeting of the expert committee on nuclear and high-energy physics of the Deutsche Physikalische Gesellschaft e. V.; Bochum, F. R. Germany (4 Mar 1974).

5 figs.; 7 refs.

In Autumn 1973 it was possible to begin with the systematic nuclear spectroscopic investigation of neutron-rich nuclei in the gas-filled separator JOSEF (Juelich On-line Separator for Fission products). In the whole light-fission-product group, the energies, half-lives and coincidence behavior of the γ-radiation which is emitted by short-lived products with high fission yield were examined. In the light-fission-product group, the nuclides with A ≈ 85 are of particular interest due to the clarification of the mechanism of the emission of delayed neutrons and with A ≈ 100 as they belong to the transition range in a region of stable nuclear deformations. (5 figures) (GE)

18542 (BNL-19360) MICROSCOPIC MODELS FOR HEAVY ION SCATTERING AT LOW, INTERMEDIATE, AND HIGH ENERGIES. Vary, J. P.; Dover, C. B. (Brookhaven National Lab., Upton, N. Y. (USA)). Sep 1974. 68p. (CONF-740740-2). Dep. NTIS $6.50.

From second high energy heavy ion summer study; Berkeley, California, USA (15 Jul 1974).

The evolution with energy of a lowest order microscopic model for nucleus—nucleus interactions from 10 MeV/nucleon to 1 TeV/nucleon is treated. The improved low energy results obtained with a more careful treatment of the densities coupled with a finite range nucleon—nucleon force are outlined. It is argued why the complexity is considerably less important as one goes to higher energies and heavier projectiles. (JFP)

18543 (IAEA-R-844-F) NUCLEAR DATA MEASUREMENTS BY ANGULAR CORRELATION TECHNIQUE AND MOESSBAUER EFFECT TECHNIQUE. Final Report for the Period 1 December 1969—30 November 1972. Zawislak, F. C. (International Atomic Energy Agency, Vienna (Austria)). Feb 1973. 7p. INIS.

The work may be summarized as follows: nuclear structure studies (8 projects)—various isotopes were investigated using the gamma—gamma and conversion electron—gamma angular correlation techniques. Properties of nuclear states (spins, parities, lifetimes and magnetic moments) and transitions (multipolarities, particle parameters) were studied experimentally and theoretically. Application of the PAC technique to nuclear hyperfine interaction studies—the PAC method was applied successfully to study nuclear hyperfine interactions (magnetic and electric) in solids. This method permits one to probe the interaction during the mean life of the excited nuclear level. Internal magnetic fields acting on radioactive impurities in ferromagnetic compounds and alloys were studied as a function of temperature, composition and location in the lattice. Electric field gradients in a series of Hf compounds were also studied. Application of M. E.—Mössbauer studies in this institute were done using only low energy transitions, since the institute did not obtain liquid helium facilities until the end of 1972. Nuclear quadrupole interactions, magnetic hyperfine interactions and isomeric shifts were measured in various systems and compounds using the Mössbauer spectroscopy with ^{57}Fe, ^{129}I and ^{119}Sn nuclei. Listed also are additions made to the laboratory equipment and facilities during this period. There are 31 references given to theses, publications, and papers in preparation, resulting from this work. (auth)

18544 (INS-R-139) ACCELERATOR PHYSICS GROUP PROGRESS REPORT, JULY—DECEMBER 1973. McCallum, G. J. (ed.). (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.). Feb 1974. 23p. INIS.

The activities of the accelerator group of the Institute of Nuclear Sciences during the period July—Dec 1973 are summarized under the headings: accelerator operation and development, instrumentation, experimental program, computers and programming, analysis of radioactive tracer measurements of sewer outfalls, staff notes, reports, publications and lectures. The experimental program covers work on the ^{50}Ti(p, γ)^{51}V and ^{54}Fe(p, γ)^{55}Co reactions, the halflife of ^{10}C, proton-induced x-ray fluorescence, charged particle activation analysis and the use of ^{18}F in dental studies. (auth)

18545 (JINR-P4-8282) EQUILIBRIUM DEFORMATIONS OF NEUTRON-RICH NUCLEI IN Ba REGION. Ivanova, S. P.; Fedotov, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The equilibrium deformations β_{20} and β_{40} are studied for Xe, Ba and Ce isotopes. (auth)

18546 (JUL-1087-RX(Ed.2)(Pt.1)) GAMMA ENERGIES. 2nd Edition. Part I. Meixner, C. (Kernforschunganlage Juelich (F. R. Germany). Inst. fuer Reactorexperimente). Jul 1974. 241p. (In German). Dep. NTIS (US Sales Only) $15.25.

The tables contain the gamma energies of almost all the radionuclides which can be produced in a reactor or with neutron generators, i.e., all neutron-rich nuclides as well as the nuclides which can be produced through (n,2n) reactions. Also included are all those proton-rich nuclides which play a role in medicine and activation analysis with charged particles. For the nuclides are given the gamma energies, their errors, the intensities, their errors, the half-life, decay mode, and production reactions. The saturated activity for the nuclides which are produced in reactions with neutrons is given in a separate table. In the first table the nuclides are arranged according to increasing atomic number; in the second table the natural radionuclides and the nuclides produced in reactions with charged particles are arranged according to their energies. (tr-auth)

18547 (JUL-1087-RX(Ed.2)(Pt.2)) GAMMA ENERGIES. 2nd Edition. Part II. Meixner, C. (Kernforschunganlage Juelich (F. R. Germany). Inst. fuer Reactorexperimente). Jul 1974. 206p. (In German). Dep. NTIS (US Sales Only) $13.50.

For each radionuclide are given the gamma energies, their errors, the intensities, their errors, the half-life, decay mode, and production reactions. In the first table in this part (table III) the nuclides produced by neutrons are arranged according to their energies, and in table IV the saturated activities are given. (RWR)

18548 (LPN-T-74-01) HEAVY IONS (Ar AND Kr) INDUCED FISSION AND FUSION. Tamain, B. (Clermont-Ferrand Univ., 63 (France)). May 1974. 149p. (In French). Dep. NTIS (US Sales Only) $10.50.

Thesis.

Heavy ions induced fission and fusion studied for a wide range of targets (between Mo and U). It was possible to distinguish fission following complete fusion from other fission types. Both fragments were detected in coincidence in two solid state detectors and their energies were measured. The results obtained for fission are: comparison of mean total fragments kinetic energies with calculated ones; comparison of fragments mass and kinetic energy distributions widths with calculated ones; angular momentum effects on fragment distributions; shell effects on fragment distributions. The results for fusion are: determination of critical angular momenta for fusion; entrance channel effects on critical angular momenta; very interesting results were obtained for krypton projectiles: fusion is very difficult to induce in this case and a new type of reaction (called quasi-fission) is pointed out. Different nuclear systems were studied at various energies, for fission: Ar + Mo, Ar + Sb, Ar + Pr, Ar + Ho, Ar + Au, Ar + Bi, Ar + Th and Ar + U, and for fusion: Ar + Mo, Ar + Sb, Ar + Ho, Ar + U, Kr + Ho, Kr + W, Kr + Bi and Kr + U. (auth)

18549 (ORO-2972-279, pp 210-240) THEORETICAL RESEARCH. 1974.

In annual report, 1974.

18550 (UUIP-871) GYROMAGNETIC RATIOS OF FIRST 2^{+} STATES IN ^{128,130,132}Xe. Arnesen, A.; Johansson, K.; Karlsson, E.; Noreland, T.; Norlin, L. O.; Ogaza, S. (Uppsala Univ. (Sweden). Fysiska Institutionen). Apr 1974. 22p. INIS.

Gyromagnetic ratios of first 2^{+} states in ^{128,130,132}Xe were determined by implantation perturbed angular correlations (IMPAC). The effective hyperfine magnetic field together with the transient magnetic field for xenon nuclei in iron was utilized to obtain the precession of the angular correlation. The precession due to the transient field was taken from systematics to be $\varphi/g = (36 \pm 3)$ mrad. The effective hyperfine magnetic field was determined in an experiment on ^{126}Xe in iron to be (900 ± 190) kGauss. The results for the g-factors are $g(128) = 0.30 \pm 0.07$, $g(130) = 0.38 \pm 0.07$, and $g(132) = 0.36 \pm 0.05$. (auth)

18551 NUCLEAR DATA SHEETS FOR A = 135. Henry, E. A. (Univ. of California, Livermore). Nucl. Data Sheets; 14: No. 2, 191-245(Feb 1975).

Nuclear data are compiled for the ten known members of the A = 135 mass chain, and decay schemes and adopted level properties are presented. This compilation is based on approximately 150 references available through April 1974. Nine drawings are included which present in pictorial form the bulk of the adopted values. Adopted level-property summaries and tabular listings of experimental data for each member of the A-chain follow the drawings. A discussion of the decay scheme for each nuclide is given in the Data Sheet section. Included in this compilation is a substantial amount of unpublished data which was available only through private communications, laboratory reports, and conference proceedings as of April 1974. While these data are the best currently available, they are subject to change before publication. The unpublished data presented include data on the decays of ^{135}I, ^{135}Xe, ^{135}Ce, ^{135}Pr, and ^{135}Nd, and on the levels of ^{135}La, ^{135}Ce, ^{135}Pr, and ^{135}Nd from (HI, xnγ) reaction studies. (auth)

18552 STATES IN ^{128}Sb AND ^{128}Te EXCITED IN THE DECAY OF $^{128}\text{Sn} \rightarrow {}^{128}\text{Sb} \rightarrow {}^{128}\text{Te}$. Krishtyak, I. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav); Gnatovich, V.; Fisher, M.; Venos, D ; Yursik, I. (Ustav Jaderne Fyziky, Rez (Czechoslovakia)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 771-773(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and' nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The energy levels of ^{128}Sb and ^{128}Te, appearing during the decay $^{128}\text{Sn} \xrightarrow{50\ \text{min}} {}^{128}\text{Sb} \xrightarrow{10\ \text{min}} {}^{128}\text{Te}$ (stable) were studied. The energy levels of ^{128}Sb and ^{128}Te were reported and the existence of the energy levels were confirmed by γ-γ coincidences. The energy levels and the relative intensity of the transitions were determined. The lg ft values were calculated for β decays in levels of ^{128}Sb and ^{128}Te. The level scheme for ^{128}Sb was obtained for the first time. (INIS)

18553 STATES IN ^{130}Sb AND ^{130}Te EXCITED IN THE DECAY OF $^{130}\text{Sn} \rightarrow {}^{130}\text{Sb} \rightarrow {}^{130}\text{Te}$. Krishtyak, I. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav); Fisher, M.; Gnatovich, V.; Venos, D.; Kuklik, A. (Ustav Jaderne Fyziky, Rez (Czechoslovakia)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 774-777(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

On the basis of measurements of the γ radiation and the γ-γ coincidences in the decay $^{130}\text{Sn} \xrightarrow{3.6\ \text{min}} {}^{130}\text{Sb} \xrightarrow{5.7\ \text{min}} {}^{130}\text{Te}$ (stable), and from consideration of the data on inelastic scattering of particles, a decay scheme was proposed for ^{130}Sn and its 5.7 min daughter isomer ^{130}Sb. The lg ft values were calculated for β decay in ^{130}Sb and ^{130}Te levels. The quantum characteristics of the levels in ^{130}Te and the multipolarities of the transitions were discussed. (INIS)

18554 STUDY ON THE GAMMA TRANSITIONS IN ^{105,107,109,111}Ag BY THE QUANTITATIVE ANALYSIS OF ANTICOINCIDENCE SPECTRA. Burmistrov, V. R.; Didorenko, V. A. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 791-801(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The decays $^{105}\text{Cd} \rightarrow {}^{105}\text{Ag}$, $^{107}\text{Cd} \rightarrow {}^{107}\text{Ag}$, $^{109}\text{Pd} \rightarrow {}^{109}\text{Ag}$, and $^{111}\text{Pd} \rightarrow {}^{111}\text{Ag}$ were studied. Data were obtained on the γ transitions in the odd isotopes of Ag by the method of quantitative analysis of the anticoincidence spectra. Level schemes and γ transition schemes were proposed for ^{105,107,109,111}Ag. (INIS)

18555 NUCLEAR SCATTERING OF PLANE–POLARIZED PHOTONS. Hayward, E. (National Bureau of Standards, Washington, D.C. 20234); Barber, W.C.; McCarthy, J.J. Phys. Rev. C 10: No. 6, 2652-2653 (Dec 1974).

Monochromatic 15.1-MeV plane–polarized photons have been scattered from seven additional targets having their E1 giant resonances near 15 MeV. They are In, Sb, Nd, Hg, Pb, Th, and U. Photons scattered through 90 ° were observed in the planes both parallel and perpendicular to the plane of the polarization vector. The observation of photons scattered along the polarization vector by the spherical vibrators indicates that the giant resonance is coupled to the quadrupole oscillations of the nuclear surface. The agreement with the predictions of the dynamic collective model is not particularly striking though there is little doubt that the phenomenon is qualitatively understood. (auth)

18556 DECAY OF ^{133}Xe^{g}. Cavallo, L.M.; Schima, F.J.; Unterweger, M.P.; (National Bureau of Standards, Washington, D. C. 20234). Phys. Rev. C 10: No. 6, 2631-2632 (Dec 1974).

The half–life of isotopically separated ^{133}Xe^{g} was determined by measurement in a $4\pi\gamma$ pressure ionization chamber. The value obtained was 5.245 days with an uncertainty of 0.006 days, which is the linear sum of the standard error at the 99% confidence limit and the estimated systematic errors. This result was confirmed by two separate half–life measurements employing a Ge(Li) detector. The γ rays which deexcite the level at 383 keV in ^{133}Cs have been observed. The intensities of the 383– and 221–keV γ rays relative to the 302–keV γ ray intensity were found to be 0.489 and 0.020 with the respective standard errors calculated to be 3.8% and 40%. (auth)

18557 STUDY OF THE LOWEST–LYING 4^{-} STATES IN ^{90}Zr AND ^{92}Zr. Chestnut, R.P.; Cecil, F.E.; McGrath, R.L. (Department of Physics, State University of New York, Stony Brook, New York 11974). Phys. Rev. C 10: No. 6, 2434-2440 (Dec 1974).

Using particle γ–coincident techniques, an upper limit of about 8 μb/sr is placed on the forward angle cross section for the excitation in (p,p′) at $E_p = 17.2$ MeV of the 4^{-} state in ^{90}Zr at 2.738 MeV. This upper limit is consistent with distorted–wave Born–approximation calculations using realistic interactions and reasonable wave functions. A 4^{-} state in ^{92}Zr is identified at 2.740 ± 0.010 MeV through the reaction ^{93}Nb(d, ^{3}He)^{92}Zr at $E_d = 17.2$ MeV. (auth)

18558 STRUCTURE, DIRECTIONAL–CORRELATION, AND LIFETIME MEASUREMENTS IN ^{95}Tc VIA ^{95}Mo(p,nγ) REACTION SPECTROMETRY. Sarantites, D.G.; Xenoulis, A.C. (Department of Chemistry, Washington University, St. Louis, Missouri 63130). Phys. Rev. C 10: No. 6, 2348-2372 (Dec 1974).

The level structure and the decay properties of levels in ^{95}Tc up to 2324 keV of excitation have been investigated via measurements of excitation functions of singles γ rays and via nγ– and $\gamma\gamma$–coincidence experiments following the ^{95}Mo(p,nγ) reaction with proton energies between 3.1 and 6.5 MeV. From these experiments and from high-resolution singles energy and directional–correlation measurements an extended decay scheme has been obtained which included 38 levels in ^{95}Tc and incorporated 106 γ rays. New levels at 882.10 ($13/2^{+}$), 957.12 ($11/2^{+}$), 1213.10 ($9/2^{+}$), 1214.53 ($7/2^{-}$), 1275.86 ($3/2^{-}$), 1281.46 ($7/2^{+}$), 1307.18 ($11/2^{+}$), 1631.97 ($9/2^{+}$,$11/2^{+}$), 1694.50 ($3/2 - 7/2$), 1920.00 ($1/2 - 5/2$), 1920.98 ($9/2^{+}$), 1958.94 ($9/2^{+}$,$7/2^{+}$), 2032.31 ($7/2^{+}$,$9/2^{+}$), 2210.5, and 2219.7 keV with the assigned J^{π} values in parentheses were postulated. Possible levels at 1033.85 ($1/2^{+}$), 1837.5, 2164.1, 2236.8, 2240.6, and 2318.2 keV are also proposed. The singles directional correlations for many transitions provided (i) reliable branching ratios, (ii) J^{π} assignments, and (iii) multipole mixing ratios δ (E2/M1) from analysis of the correlations via the compound statistical theory for nuclear reactions. Lifetimes for 22 states in ^{95}Tc and lower limits for 7 additional states were obtained by the Doppler–shift–attenuation method via the ^{95}Mo(p,nγ) reaction at 4.38 and 4.88 MeV. The lifetimes were extracted from singles spectra taken in the presence of standards at seven or nine angles between 0° and 90°

to the beam direction, by employing a careful centroid shift analysis of the data. For a good number of transitions in ^{95}Tc values or limits for B(E1), B(E2), and B(M1) were obtained. The present results would support a description in terms of three quasiparticle configurations with coupling to the quadrupole vibrations. (auth)

18559 NUCLEAR REACTIONS OF SILVER WITH 300–GeV PROTONS. English, G.; Yu, Y.W.; Porile, N.T. (Department of Chemistry, Purdue University, Lafayette, Indiana 47907). Phys. Rev. C 10: No. 6, 2281-2285 (Dec 1974).

The interaction of silver with 300–GeV protons was studied and compared with that of 11.5–GeV protons. Cross section ratios, $\sigma_{300}/\sigma_{11.5}$, were determined for 74 nuclides ranging from ^{7}Be to ^{106}Ag^m. The weighted average value of $\sigma_{300}/\sigma_{11.5}$ is 1.01 ± 0.10. A detailed examination of the dependence of the ratios on product A and N/Z reveals that the only difference occurs in the A ~ 20–30 mass region, where a 17 ± 5% increase in cross sections is observed at 300 GeV. (auth)

18560 NUCLEAR REACTIONS OF SILVER WITH 11.5–GeV PROTONS. English, G.; Porile, N.T. (Department of Chemistry, Purdue University, Lafayette, Indiana 47907); Steinberg, E.P. Phys. Rev. C 10: No. 6, 2268-2280 (Dec 1974).

The interaction of silver with 11.5–GeV protons was studied and formation cross sections of 72 radionuclides were determined by direct assay of the target with a Ge(Li) γ–ray spectrometer followed by computer analysis of the spectra. The data were used to construct charge–dispersion and mass–yield curves. Comparison with previous radiochemical studies performed with 29–GeV protons indicates good agreement between the two techniques. The data are compared with Rudstam systematics. This formulation predicts a much steeper decrease in isobaric cross sections with decreasing A than is observed experimentally. (auth)

18561 INELASTIC SCATTERING OF THERMAL NEUTRONS BY NUCLEAR ISOMERS. Hamermesh, B. (The Cleveland State University, Cleveland, Ohio 44115). Phys. Rev. C 10: No. 6, 2397-2398 (Dec 1974).

An attempt to measure the radiationless decay of an isomer has been made by studying the reaction ^{123}Te^m(n, n')^{123}Te. The ^{123}Te^m (104 day) was placed in a beam of thermal neutrons. The transfer of the excitation energy of the isomer to the passing slow neutron produces highly monochromatic neutrons at 89 keV. An upper limit for the cross section was determined as 20 mb. (auth)

18562 CHANNEL CORRELATIONS OF THE COMPOUND–NUCLEAR DECAY IN THE PRESENCE OF A DOORWAY–STATE REACTION MECHANISM. Graw, G.; Clement, H.; Feist, J.H.; Kretschmer, W.; Pröschel, P. (Physikalisches Institut der Universität Erlangen–Nürnberg, Erlangen, West Germany). Phys. Rev. C 10: No. 6, 2340-2347 (Dec 1974).

Inelastic reactions that proceed via a doorway–state mechanism, e.g. an isobaric analog resonance (IAR), have a complete correlation of the fluctuations of the scattering matrix elements between resonant channels if, in these channels, other mechanisms of compound–nucleus formation can be neglected. Then the polarization P(θ) of the resonant fluctuating cross section is energy independent and the same as for the resonant direct decay. This is supported by the analysis of experimental data for σ (θ), A(θ), and P(θ) for the ^{90}Zr(p, p$_2$)^{90}Zr(2$^+$, 2.18 MeV) reaction at E_p = 7.65 MeV in an IAR with J^π = 3/2$^+$. (auth)

18563 LEVELS OF ^{93}Rb, ^{93}Sr, AND ^{93}Y FED IN THE DECAYS OF ^{93}Kr, ^{93}Rb, AND ^{93}Sr. Achterberg, E.; Iglesias, F.C.; Jech, A.E.; Moragues, J.A.; Otero, D.; Pérez, M.L.; Proto, A.N.; Rossi, J.J.; Scheuer, W. (Departamento de Fisica Nuclear, Comisión Nacional de Energia Atómica, Buenos Aires (29), Argentina). Phys. Rev. C 10: No. 6, 2526-2539 (Dec 1974).

The γ rays and conversion electrons following the β^- decay of ^{93}Kr, ^{93}Rb, and ^{93}Sr have been measured by applying on–line mass–separation techniques to ^{235}U fission products. Level schemes for the three daughter nuclei are proposed based on the study of γ–singles, $\gamma\gamma$–coincidence, and internal–conversion electron spectra. Internal–conversion coefficients were determined for 10 transitions and the deduced multipolarities as well as logft values were combined with known reaction results to assign spins and parities. The half–life for the 758.63–keV isomeric level in ^{93}Y was measured to be 85 ± 15 msec. (auth)

18564 Q_β VALUES OF NEUTRON–RICH Cs ISOTOPES. Wünsch, K.; Wollnik, H.; Siegert, G. (Physikalisches Institut der Justus Liebig–Universität Giessen, Germany). Phys. Rev. C 10: No. 6, 2523-2525 (Dec 1974).

An on–line separator equipped with a thermal ion source was used to determine decay energies of mass–separated neutron–rich Cs fission products. From the β spectrum end–point energies from singles experiments as well as from β–γ coincidence experiments, the Q_β values of ^{141,142,143,144,145}Cs were determined to be 4.95 ± 0.15 MeV, 6.77 ± 0.2, MeV, 5.65 ± 0.2 MeV, 8.1 ± 0.3 MeV, and 6.1 ± 0.5 MeV, respectively. (auth)

18565 ^{92,98}Mo(d,α)^{90,96}Nb REACTIONS AND PARTICLE–HOLE MULTIPLETS. Comfort, J.R. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439 and Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540); Fortune, H.T.; Morrison, G.C.; Maher, J.V. Phys. Rev. C 10: No. 6, 2399-2415 (Dec 1974).

The ^{92,98}Mo(d,α)^{90,96}Nb reactions have been studied at a bombarding energy of 17 MeV. Attention is given to the states previously observed in (^{3}He,t) reactions that are thought to arise from simple particle–hole multiplets. Distorted–wave (DW) calculations were carried out with spectroscopic amplitudes calculated from assumed simple configurations. The DW calculations are found to be sensitive to variations in a number of parameters. It is found that the normalization constants needed to fit the observed cross sections vary widely for members of a single multiplet. In addition, the average normalization constants needed for states of the $(g_{9/2})^2$ multiplet in ^{90}Nb and the $(g_{9/2}d_{5/2})$ multiplet in ^{96}Nb differ by a factor of 4. (auth)

18566 MATTER RADII OF THE EVEN TIN ISOTOPES FROM ELASTIC α AND ^{16}O SCATTERING. Tabor, S.L.; Watson, B.A.; Hanna, S.S. (Department of Physics, Stanford University, Stanford, California 94305). Phys. Rev. C 11: No. 1, 198-204 (Jan 1975).

The elastic scattering of α and ^{16}O particles from ^{116,118,120,122,124}Sn has been measured at α energies between 9 and 17 MeV and at ^{16}O energies between 46 and 59 MeV. Fits have been made to the data with the optical and the incoming wave boundary condition models. The radius at which the nuclear potential is 2% of the Coulomb potential is minimally sensitive to the ambiguities of the fit. The increases in nuclear matter size as A increases over the tin isotopes, measured by α and by ^{16}O scattering, agree reasonably well with each other and with the increase measured by proton scattering. However, the increase in the size of the matter distribution is 2 to 3 times larger than that of the charge distribution as observed in muonic atom and electron scattering studies. (auth)

18567 DOUBLE K–SHELL IONIZATION IN THE INTERNAL–CONVERSION DECAY OF ^{109}Ag^m. Nagy, H.J.; Schupp, G.; Hurst, R.R. (Department of Physics, University of Missouri–Columbia, Columbia, Missouri 65201). Phys. Rev. C 11: No. 1, 205-212 (Jan 1975).

Double ionization of the atomic K shell accompanying the K–shell internal conversion of the 88.0–keV $E3$ transition of ^{109}Ag^m has been studied by recording coincidences between K x rays and $K\alpha$ x rays emitted when the double vacancies are filled. The probability per K–shell internal conversion that a double K–shell vacancy is formed, T_{KK}, was found to be (1.53 ± 0.24) × 10^{-4}, and is about a factor of 5 smaller than a previous measurement. The energy shift, ΔE, of the $K\alpha$ "hypersatellite" x ray was measured to be (373 ± 75) eV. (auth)

18568 COULOMB EXCITATION OF LEVELS IN ^{95}Mo AND ^{97}Mo. Barrette, J.; Barrette, M.; Haroutunian, R.; Lamoureux, G.; Monaro, S. (Laboratoire de Physique Nucléaire and Département de Physique, Université de Montréal, Montréal, Québec, Canada); Markiza, S. Phys. Rev. C 11: No. 1, 171-187 (Jan 1975).

The properties of the low–lying levels of ^{95}Mo and ^{97}Mo have been investigated via Coulomb excitation which was effected by bombarding isotopically enriched thick targets with 6.0-to 10.0-MeV α particles and 43.4-MeV ^{16}O ions. Sixteen transitions in ^{95}Mo and twenty-three transitions in ^{97}Mo were observed resulting from direct $E2$ excitation of eight excited states up to an excitation energy of 1073.7 keV in ^{95}Mo, and of thirteen excited states up to an excitation energy of 1515.5 keV in ^{97}Mo. Angular distribution measurements were carried out for several transitions in both nuclei to aid in the assignment of spins and to yield the $E2$ and $M1$ contents in these transitions. The level structure of ^{95}Mo and ^{97}Mo and the measured $E2$ and $M1$ transition rates are compared with the predictions available for these nuclei. (auth)

18569 COULOMB EXCITATION OF ^{125}Te. Barrette, J.; Barrette, M.; Haroutunian, R.; Lamoureux, G.; Monaro, S. (Laboratoire de Physique Nucléaire, Département de Physique, Université de Montréal, Montréal, Canada); Markiza, S. Phys. Rev. C 11: No. 1, 282-286 (Jan 1975).

The properties of the low–lying levels of ^{125}Te were investigated by the Coulomb excitation process which was effected by bombarding a thick natural tellurium target with 9.5– and 10.5–MeV α particles and a thick target of isotopically enriched ^{125}Te (95%) with 45–MeV ^{16}O ions. Levels at 443.58, 463.39, 671.42, and 729.30 keV were Coulomb excited and the reduced upward transition probabilities $B(E2\uparrow)$ (e^{2}b^2) extracted from the data were: 0.186 ± 0.005, 0.158 ± 0.005, 0.130 ± 0.004, and 0.0059 ± 0.0008. Angular distribution measurements were performed with 42–MeV ^{16}O ions. The following results were obtained for the γ rays deexciting the 443.58– (3/2$^+$) keV level: δ(408.10) = +0.41(5) or +1.35(12), δ(443.58) = +0.14(4) or −2.4(3). (auth)

18570 COULOMB–NUCLEAR INTERFERENCE FOR THE (*d, d'*) REACTION ON ISOTOPES OF Nd. Baker, F.T.; Hartwig, W.; Kruse, T.H.; Ventura, E. (Department of Physics, Rutgers University, New Brunswick, New Jersey 08903). Phys. Rev. C 11: No. 1, 262-263 (Jan 1975).

Excitation functions at 140° laboratory angle have been measured for inelastic deuteron scattering to the first 2^+ states of ^{142,144,146,148,150}Nd. The anomalous destructive Coulomb–nuclear interference previously observed for other $N = 82$ isotones also occurs for ^{142}Nd. This anomaly is seen to be a sudden change in the nature of the interference rather than a gradual change as one approaches this closed shell. (auth)

18571 ENERGY DEPENDENCE OF THE (*p, n*) ANALOG CROSS SECTIONS OF THE MOLYBDENUM ISOTOPES BETWEEN 16 AND 26 MeV. Grimes, S.M.; Poppe, C.H.; Anderson, J.D.; Davis, J.C.; Dunlop, W.H.; Wong, C. (Lawrence Livermore Laboratory, Livermore, California 94550). Phys. Rev. C 11: No. 1, 158-170 (Jan 1975).

The differential cross sections for the (*p, n*) reaction to the ground–state analogs of the seven stable Mo isotopes have been measured for proton energies between 16 and 26 MeV. Integrated cross sections are found to deviate from the expected linear dependence on neutron excess. In addition, the excitation functions show a resonant–type enhancement at about 20 MeV. The (N–Z) dependence and energy dependence are not consistent with several possible explanations for deviations from the simple charge exchange model. However, the $(N - Z)$ dependence for the even isotopes can be explained in part by the effects of multistep processes. (auth)

18572 ABSOLUTE CROSS SECTIONS FOR (^{14}N, 4*n*) AND (^{14}N, 5*n*) REACTIONS INDUCED ON ^{141}Pr AND ^{142}Nd. Schmidt–Ott, W. (UNISOR, Oak Ridge, Tennessee 37830); Toth, K.S.; Zganjar, E.F. Phys. Rev. C 11: No. 1, 154-157 (Jan 1975).

Cross sections for the reactions (^{14}N, 4*n*) and (^{14}N, 5*n*) induced on ^{141}Pr and ^{142}Nd were determined by detecting the α decay of the products, ^{151,150}Dy and ^{152,151}Ho, respectively. The experimental technique consisted of a direct recoil catch measurement combined with one using a gas–jet–capillary system. With recently determined α–decay branching ratios counting rates were converted into absolute cross sections. Reasonable agreement was found between these experimental data and results obtained from statistical–model calculations. (auth)

18573 RESONANCE FLUORESCENCE OF EXCITED NUCLEAR LEVELS IN THE ENERGY RANGE 5 TO 11 MeV. Arad, B.; Ben-David, G. (Soreq Nuclear Research Center, Yavne, Israel). Annu. Rev. Nucl. Sci.; 24: 35-67(1974).

After a primarily historical introduction, experimental facilities and techniques are briefly surveyed: these include general scattering facilities, detectors and beam monitors, and background reduction. Then the derivation of level parameters from scattering experiments is considered; absolute beam intensity measurements, variation of scattered γ ray intensity with target temperature, self-absorption experiments, energy variation of the neutron-capture γ rays, energy variation of resonantly scattered γ rays with variation of the scattering angle, and angular distribution and polarization measurements of the scattered γ rays are included. Then experimental results of resonance fluorescence experiments are given; these include the following: the 7277-keV level in ^{208}Pb; levels in ^{141}Pr; nonstatistical effects in (γ,γ') reactions; radiative widths and γ-ray transition strengths of the resonance levels; fluctuations of partial radiation widths from γ resonance levels; elastic and inelastic scattering of capture γ rays in the continuous region–observation of nuclear Raman scattering. (11 figures, 6 tables, 82 references) (RWR)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 18121, 18546–18548, 18578, 18596, 18603, 18659, and 18737.

18574 (JINR–P4-8326) SYMMETRY PROPERTIES OF COLLECTIVE STATES OF DEFORMED NUCLEI. Dzholos, R. V.; Denau, F.; Yanssen, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

On the basis of a collective Hamiltonian, constructed in the framework of the microscopic nucleus model, the properties of low lying collective states of deformed nuclei ^{168,170,172}Yb, ^{174,176}Hf were analyzed. It was shown that consideration in the framework of SU_3 scheme gives a qualitatively correct description of deformed nuclei. Deviations from this scheme are analyzed. (auth)

18575 (JINR-P6-8229) IDENTIFICATION OF ^{160}Yb. Beyer, G.; Honusek, M.; Siebert, H. U.; Zuber, K.; Zuber, J.; Latuszynski, A.; Penev, I.; Potempa, A. W.; Strusny, H.; Jachim, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The existence of the isotope ^{160}Yb with a half-life of $T_{1/2} = (4.8 \pm 0.2)$ min was established. Intensities and energies of gamma rays from the decay of this isotope were measured. (3 figures, 1 table) (auth)

18576 (JINR-P6-8316) DECAY OF ^{153}Tb. Aleksandrov, V. S.; Vylov, Ts.; Gromova, I. I.; Gromov, K. Ya.; Iskhakov, G.; Kuznetsov, V. V.; Lebedev, N. A.; Potempa, M.; Fominykh, M. I.; Khamidov, A. Sh.; Kholbaev, I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 30p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The γ-ray and $\gamma-\gamma$-coincidence spectra and those of conversion electrons were studied at ^{153}Tb decay. Based on the energy, γ-transition intensity and on the analysis of the $\gamma-\gamma$-coincidence spectra and γ-ray spectrum (measured using Ge(Li) detectors with 4π geometry) γ-transitions were suggested to be positioned in the decay scheme $^{153}\text{Tb} \rightarrow {}^{153}\text{Gd}$. (auth)

18577 DECAY OF ^{170}Ho ISOMERS TO LEVELS IN ^{170}Er. Kawade, K.; Hiei, A.; Yamamoto, H.; Amemiya, S.; Katoh, T. (Nagoya Univ., Japan). J. Phys. Soc. Jap.; 36: No. 5, 1221-1229 (May 1974).

Beta- and gamma-rays emitted in the decay of ^{170}Ho isomers were studied with Ge(Li), NaI(Tl) and plastic detectors. Sources were prepared by the ^{170}Er(n,p)^{170}Ho reaction with about 15-MeV neutrons. Fifty γ-rays were observed, and thirty-six of them are assigned to the ^{170}Er level scheme including seven new levels at 1010.5, 1217.3, 1900.5, 1982.6, 2039.3, 2684.8 and 3606.2 keV. The most probable spin assignments of 1± and 4± are proposed for the 43 sec and 2.8 min ^{170}Ho, respectively. Both Q_β values are 4.0 ± 0.2 MeV. The $K = 0$ assignment for the 2^+ state at 959.8 keV is proposed from the E2 branching ratios to the ground-state band. It is found that the relative B(E2) values from γ-vibrational band can not be explained by a single value of the band mixing parameter Z_2. (auth)

18578 DETERMINATION OF THE K-CAPTURE RATE IN THE DECAY OF $^{153}\text{Gd} \rightarrow {}^{153}\text{Eu}$. Sergienko, V. A.; Lebedev, V. M. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 802-806(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The γ spectra of the decay $^{153}\text{Gd} \rightarrow {}^{153}\text{Eu}$ was studied. The intensity of the K capture and the total number of decays in the ground and excited states of the daughter nucleus were determined in per cent of decays. A level scheme for ^{153}Eu was given. (INIS)

18579 DETERMINATION OF THE MOST PROBABLE ENERGY OF TRANSITIONS OBTAINED IN THE DECAYS OF $^{171}\text{Lu} \rightarrow {}^{171}\text{Yb}$ AND $^{172}\text{Lu} \rightarrow {}^{172}\text{Yb}$. Balalaev, V. A.; Dzhelepov, B. S.; Medvedev, A. I.; Ter-Nersesyants, V. E.; Uchevatkin, I. F.; Shestopalova, S. A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Metrologii, Leningrad (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 681-688(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

All available combinations of data on the energy of the decay of ^{171,172}Lu were reprocessed. In order to improve the decay schemes of $^{171}\text{Lu} \rightarrow {}^{171}\text{Yb}$ and $^{172}\text{Lu} \rightarrow {}^{172}\text{Yb}$ accurate data on the transition energies are necessary. By use of a new calibration of the spectrometer and precise values of the energies of the internal reference lines, the electron conversion energy was recalculated from previously published works of the author. (INIS)

18580 ROTATIONAL BANDS IN NUCLEI WITH ODD A. Kemnits, P.; Funke, L.; Sodan, Kh.; Vinter, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 780(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The rotational excited states of ^{155,157}Tb, ^{161,163}Ho, ^{167}Tm, ^{171,173}Lu, ^{179}Ta, and ^{185}Os were studied by the beam spectroscopy method. Up to five rotational bands, aligned in low lying states, were detected for each nucleus. The maximum value of the spins of the observed levels was $I = {}^{29}/_{2}$. The experimental results were interpreted in the framework of the rotator model. (INIS)

18581 STATES IN ^{171}Lu EXCITED IN THE DECAY OF ^{171}Hf. Gnatovich, V.; Zvol'ska, V.; Zvol'ski, I.; Rzhikovska, I.; Kuklik, A.; Mashtalka, A.; Fisher, M. (Ustav Jaderne Fyziky, Rez (Czechoslovakia)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 781-790(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The γ spectra and γ-γ coincidences during the decay ^{171}Hf → ^{171}Lu were measured. A level scheme was proposed for ^{171}Lu. The relative intensities and multipolarities of the transitions, the spins and parity of the ^{171}Lu levels were reported. (INIS)

18582 ^{180}Hf ENERGY LEVELS DEDUCED FROM THERMAL AND AVERAGE RESONANCE NEUTRON–CAPTURE γ–RAY SPECTRA. Bushnell, D.L. (Northern Illinois University, DeKalb, Illinois 60115 and Argonne National Laboratory, Argonne, Illinois 60439); Buss, D.J.; Smither, R.K. Phys. Rev. C 10: No. 6, 2483-2511 (Dec 1974).

An energy level diagram for ^{180}Hf is developed on the basis of neutron–capture γ–ray spectroscopy. Both thermal neutron capture and average resonance neutron–capture studies were made with isotopically enriched and natural Hf samples. The energies and intensities of the high–energy 7.4–4.7 MeV primary γ transitions and the intermediate–energy 2.1–0.5 MeV γ transitions were made with the in–pile (n, γ) source facility at the Argonne research reactor using Ge(Li) γ–ray detectors. The low–energy 1300–1330 keV γ transitions were measured with the Argonne 7.7 m bent–crystal γ–ray spectrometer which also uses an in–pile (n, γ) source at the Argonne reactor. The final level scheme contains 41 levels with excitation energies up to 2.7 MeV. Twenty–six new levels are reported. Parity assignments are made for all but three of these levels. Unique spin assignments are made for 21 levels and the spin of 15 additional levels was limited to two choices. The possible existence of excited state rotational bands was explored. Two K = 0 excited state bands and a K = 2 excited state band were identified. (auth)

18583 E0/E2 TRANSITION STRENGTHS AND INTERPRETATIONS OF 0^+, 2^+ STATES IN ^{178}Hf. Hamilton, J.H.; Kumar, K.; Varnell, L.; Ramayya, A.V.; Little, P.E. (Physics Department, Vanderbilt University, Nashville, Tennessee 37235); Johnson, N.R. Phys. Rev. C 10: No. 6, 2540-2544 (Dec 1974).

Six measured X(E0/E2) values of ^{178}Hf are reported and compared with nuclear models. Three of these values are considerably larger than the β–vibrational model estimates. Experiments are suggested to test the possibility that large X values indicate mostly proton excitations. (auth)

18584 DETERMINATION OF $B(E2,0^+ \rightarrow 2^+)$ FOR SOME EVEN–EVEN NUCLEI IN AND NEAR THE RARE–EARTH REGION. Baktash, C.; Saladin, J.X.; O'Brien, J.; Lee, I.Y.; Holden, J.E. (University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. C 10: No. 6, 2265-2267 (Dec 1974).

α particles in the 11.5–13.5 MeV energy range have been employed to Coulomb excite the $2^{+\prime}$ members of the γ–vibrational band of nine even–even nuclei in the $158 \leq A \leq 186$ mass region. The $B(E2,0^+ \rightarrow 2^{+\prime})$ values were then determined by energy analyzing the backscattered projectiles. The results for ^{158,160}Gd, ^{162,164}Dy, ^{166,168,170}Er, and ^{184,186}W are 0.106 ± 0.015, 0.104 ± 0.004, 0.130 ± 0.005, 0.121 ± 0.005, 0.140 ± 0.006, 0.130 ± 0.005, 0.107 ± 0.006, 0.138 ± 0.006, and 0.139 ± 0.004 (e^2 b^2), respectively. (auth)

18585 α–DECAY BRANCHING RATIOS FOR ^{151}Tb, $^{150-153}$Dy, AND $^{152-155}$Er. Toth, K.S. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Bingham, C.R.; Schmidt–Ott, W. Phys. Rev. C 10: No. 6, 2550-2560 (Dec 1974).

The isotopes $^{152-155}$Er and ^{151}Tb, $^{150-153}$Dy were produced by bombarding ^{147}Sm and ^{144}Nd, respectively, with ^{12}C ions accelerated in the Oak Ridge isochronous cyclotron. With the use of a gas–jet–capillary transport system α–particle, x–ray, and γ–ray spectra were measured simultaneously, and α–decay branching ratios, deduced for the above mentioned nuclides. The ratios were determined primarily by measuring the number of $K\alpha_1$ x rays emitted and then applying appropriate correction factors to obtain the total number of electron capture and positron decays. In addition, for ^{150,152,153}Dy it was possible to deduce alternate, and thus independent, α–decay branching ratios from γ–ray spectral measurements. Within error limits the two sets of values were found to be in agreement. Because of the essentially equal half–lives of ^{151}Tb and ^{152}Tb the α branch for ^{151}Tb could not be determined from the $K\alpha_1$ ray intensity; instead it was deduced solely on the basis of its known decay to levels in ^{151}Gd. Branches for ^{149}Tb, ^{149}Tb^m, and ^{150}Tb, as well as for the fine structure α decays observed in the case of ^{153}Dy and ^{149,151}Tb, were taken from a survey of published values. These data were combined with our own results and α–decay reduced widths were calculated using the formalism developed by Rasmussen. As is customary, reduced widths for ground–state transitions between even–even nuclei were assumed to represent unhindered decay and then compared with values for the remaining α decays. As we had found earlier for the neighboring odd–Z holmium nuclides, these latter reduced widths ranged from values close to those of even–even nuclei down to much smaller ones. This result is examined from the standpoint of what is known about spin assignments for states connected by specific α–decay transitions. (auth)

18586 ONE–QUASIPARTICLE STATES IN ^{163,165}Ho OBSERVED IN THE (^{3}He,d) AND (α,t) REACTIONS. Lewis, D.A.; Broad, A.S.; Gray, W.S. (Cyclotron Laboratory, Physics Department, The University of Michigan, Ann Arbor, Michigan 48105). Phys. Rev. C 10: No. 6, 2286-2300 (Dec 1974).

The (^{3}He, d) and (α, t) stripping reactions on ^{162}Dy and ^{164}Dy have been studied at bombarding energies of 46.5 and 45.5 MeV, respectively. Angular distributions for the (^{3}He, d) reaction were measured over the angular range 0–35°. The experimental resolution of approximately 15 keV full width at half–maximum was sufficient to permit extraction of l transfers and spectroscopic factors for 32 levels in ^{163}Ho and ^{165}Ho below 1.6 MeV of excitation, using the conventional distorted–wave Born approximation (DWBA). Previous identification from decay studies of the $7/2^-[523]$, $1/2^+[411]$, and $3/2^+[411]$ bands in both nuclei, and the $1/2^-[541]$ band in ^{163}Ho, were confirmed. New assignments include the $5/2^+[402]$ and $9/2^-[514]$ bands in ^{163}Ho and the $1/2^-[541]$ and $1/2^+[660]$ bands in ^{165}Ho. Also the K = 5/2 band beginning at 1056 keV in ^{165}Ho has been identified as the $5/2^+[402]$ band, in contradiction to a tentative previous assignment from decay work. A few additional levels were observed which could not be positively identified with predicted Nilsson–model states. These include a level populated by l = 0 transfer and another with l = 2 in each isotope, in the 1.1–1.6–MeV excitation region. The presence of these transitions and their spectroscopic factors suggest fragmentation of the $1/2^+[400]$ and possibly the $3/2^+[402]$ orbitals. The measured elastic scattering is adequately represented by coupled–channels calculations, but not optical model predictions, when potential parameters derived from the lead region are used. With these parameters the DWBA yields spectroscopic factors which are in qualitative agreement with Nilsson–model predictions, although the over–all pattern of agreement is somewhat improved if the absolute values are reduced by 30–40%. The measured angular distributions are generally well reproduced by the DWBA except for the transition to the $5/2^-$ member of the $1/2^-[541]$ band in both nuclei. No other indications of possible indirect contributions to the reactions, which have been observed in neutron–transfer reactions at lower energies, were apparent in comparison with DWBA predictions. (auth)

18587 ELECTRIC MONOPOLE ADMIXTURES IN INTERBAND TRANSITIONS OF ^{154}Gd. Gono, Y.; Sugihara, T.T. (Cyclotron Institute, Texas A&M University, College Station, Texas 77843). Phys. Rev. C 10: No. 6, 2460-2466 (Dec 1974).

The in–beam conversion–electron spectrum for the reaction ^{154}Sm(α, 4n)^{154}Gd has been obtained at 45 MeV. Strong E0 components are observed for interband transitions between states in the β and ground bands up to at least spin 10 and probably also spin 12. The ratio of transition probabilities E0 to E2 is found to be essentially constant for I_β in the range 2 to 10. No evidence for a dramatic change which might be associated with backbending phenomenon is seen. (auth)

18588 DECOUPLED $i_{13/2}$ NEUTRONS AND BACKBENDING IN W AND Os ISOTOPES. Bernthal, F.M.; Boyno, J.S.; Khoo, T.L.; Warner, R.A. (Departments of Chemistry and Physics and Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. Lett. 33: No. 21, 1313-1316 (18 Nov 1974).

Analysis of rotational band structure in odd–N deformed rare–earth nuclei shows that if rotation–particle decoupling is the correct explanation for backbending in the region N=92–96, then it can also explain the phenomenon in ^{180}W and ^{182,184,186}Os. (auth)

18589 IZOBARNYYE YADRA S MASSOVYM CHISLOM A = 170. (Isobaric Nuclei with Mass Number A = 170). Dzhelepov, B. S.; Shestopalova, S. A. Leningrad; Izdatel'stvo Nauka (1972). 332p.

This monograph is devoted to the properties of the isotopes ^{170}Ho, ^{170}Er, ^{170}Tm, ^{170}Yb, ^{170}Lu, ^{170}Hf, ^{170}Ta, ^{170}W, and ^{170}Os. All the experimental data characterizing the properties of stable and radioactive isotopes are compared: data on nuclear masses, magnetic and electric moments, lifetimes of nuclear states, spectra of gamma rays and conversion electrons, γ–γ and γ–e coincidences, and nuclear reactions resulting in excited states of the above-enumerated nuclei. On the basis of critical analysis of the entire aggregate of data the decay schemes of the radioactive nuclei of ^{170}Ho, ^{170}Tm, ^{170}Lu, and ^{170}Hf are derived, as well as sequences of excited states in ^{170}Er, ^{170}Tm, ^{170}Yb, and ^{170}Lu. Substantiations are given for the selection of quantum characteristics for each nuclear state. After the experimental facts are sampled, they are compared with modern theories and nuclear models—the models of Bohr and Mottelson, Davydov et al., and Solov'yev et al. Anomalies of various kinds are revealed which must be studied for a better understanding of nuclear structure. (auth)

18590 X$-\gamma$ RAY ANGULAR CORRELATION IN INTERNAL CONVERSION. Piticu, I.; Vata, I. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 8, 835-842(1974).

The angular correlation function $W_{x-\gamma}$ (θ) is written in the form of a linear combination of the partial matrix elements M_{κ}. The factor values K_{LL} for the nuclear transition with L = 1,2 and for the energy between 0.05 to 0.15 m_0c^2 and for $73 \leq Z \leq 92$ are presented. (auth)

18591 ROTATIONAL BAND STRUCTURE IN N = 105 AND 107 ISOTONES: I. EVIDENCE FOR THE TRANSITION TO $|IRj\rangle$ COUPLING AT HIGH SPINS IN ^{179}W. Bernthal, F.M.; Warner, R.A. (Departments of Chemistry and Physics and Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. C 11: No. 1, 188-197 (Jan 1975).

The ^{177}Hf(α, $2n\gamma$) and ^{181}Ta(p, $3n\gamma$) reactions have been employed in a study of the ^{179}W rotational band structure. Attention is focused on the unique-parity $9/2^+[624]$ band and its highly perturbed rotational structure. The higher-spin members of the even-parity band in ^{179}W are not well characterized by a single K quantum number and are better represented in the $|IRj\rangle$ weak-coupling scheme. Limits are placed on the hexadecapole deformation consistent with the rotational band structure in ^{179}W. The relevance of the even-parity band structure in ^{179}W to backbending in neighboring even-A nuclei is discussed. (auth)

18592 CORIOLIS PERTURBATION EFFECTS FOR K = 3/2 ROTATIONAL BANDS IN ODD-PROTON RARE-EARTH NUCLEI. Joshi, P.C.; Sood, P.C. (Nuclear Physics Section, Department of Physics, Banaras Hindu University, Varanasi 221005, India). Phys. Rev. C 11: No. 1, 269-273 (Jan 1975).

The evidence for the rotation-particle coupling effect in K = 3/2 band levels in odd-proton rare-earth nuclei is examined. Empirical analysis establishes the presence of an alternating term in the rotational energy expression and phenomenological fits to the observed energies result in an evaluation of the coefficient of the alternating energy term. Interpretation of this coefficient as arising from the perturbation treatment of the Coriolis interaction term is examined through theoretical calculation employing the usual Nilsson model potential. The effect of the variation of the potential parameters and the introduction of a deformation in the spin-orbit term are studied. The results are compared with those obtained in an earlier similar study of the odd-neutron rare-earth nuclei. (auth)

18593 MICROSCOPIC STUDY OF THE VARIABLE-MOMENT-OF-INERTIA MODEL FOR RARE-EARTH NUCLEI. Ma, C.W. (Physics Department, Indiana University, Bloomington, Indiana 47401 and Physics Department and Cyclotron Institute, Texas A&M University, College Station, Texas 77843); Tsang, C.F. Phys. Rev. C 11: No. 1, 213-227 (Jan 1975).

Based on the microscopic cranking model, the moment-of-inertia parameter J_0 and the force constant C_{VMI} associated with the variable-moment-of-inertia model are calculated microscopically for rare-earth nuclei. Higher-order effects representing quadrupole and hexadecapole centrifugal stretching, proton and neutron Coriolis-antipairing effects, and fourth-order cranking correction are included. The present calculations are able to reproduce the trend and the magnitude of both J_0 and C_{VMI} fairly well with discrepancies ranging from 10 to 40%. (auth)

Nuclear Properties and Reactions, $190 \leq A \leq 219$

Refer also to abstracts 18430, 18497, 18504, 18509, 18522, 18533, 18546–18548, 18555, 18573, 18590, and 18655.

18594 (AD-783857) ELECTROEXCITATION OF GIANT RESONANCES BETWEEN 5 MeV AND 40 MeV EXCITATION ENERGY IN ^{197}Au. Ferlic, K. P.; Waddell, R. D. (Naval Postgraduate School, Monterey, Calif. (USA)). Jun 1974. 111p. NTIS $8.75.

Thesis.

Inelastic electron scattering from ^{197}Au between 5 MeV and 40 MeV excitation energy revealed giant multipole resonances. Angular distribution studies with incident 90 MeV electrons show evidence of previously unreported giant monopole states. Reduced matrix elements were extracted and multipolarity assignments were made. Seven states were observed at excitations of 7.3 (undetermined magnetic), 9.2 (E0), 10.8 (E2), 14.0 (E1), 18.0 (undetermined), 22.5 (E2), and 33.5 MeV (E0 or E2). (auth)

18595 (AED-CONF-74-044-010) STUDY OF INTERNAL PAIR PRODUCTION IN ^{200}Hg AFTER NEUTRON CAPTURE. Waldschmidt, M. (Frankfurt Univ. (F. R. Germany). Inst. fuer Kernphysik). 1974. 2p. (In German). INIS.

From exhibition and experts' meeting "nuclear technology"; Frankfurt am Main, F. R. Germany (18 Mar 1974).

2 figs.

Internal pair production, just as internal conversion, can be of use in the determination of the multipole order of the energy-level transitions involved. A brief description is presented of the usually difficult analysis of spectra by using the example of the ^{200}Hg nucleus excited by neutron capture. (2 figures) (GE)

18596 (IPNO-T-74-06) SEARCH FOR AND IDENTIFICATION OF CRITICAL OR SUPERSOFT NUCLEI (EXPERIMENTAL AND THEORETICAL ASPECTS). Cailliau, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1974. 144p. (In French). Dep. NTIS (U. S. Sales Only) $10.25.

Thesis.

The aim of this work was the research in the isotope chart of i) regions of shape instability, ii) oblate deformation regions of critical nuclei located at the limit of oblate, prolate and spherical nuclei. Instrumental developments have been performed in: i) Q_β measurements far from stability with plastic detector; Q_β values for Rb → Sr disintegrations have been measured for $89 \leq A \leq 96$ and pairing energies Δ_{nn} deduced, ii) on-line angular correlation: measurements with Ge(Li) detectors for short-lived isotopes: Au → Pt disintegrations for $182 \leq A \leq 192$ have been studied. A low-lying 0_2^+ level is found in ^{186}Pt, ^{184}Pt, and likely also in ^{182}Pt, respectively located at 471.5 keV, 492.5 keV, 499.5 keV. The semimicroscopic approach of Kumar and Baranger has been used for the theoretical interpretation of these results. If the low energy of the 0_2^+ level is not properly predicted by this model, predictions for B(E2) and mixing ratios δ(E2/M1) are satisfactory. It has been deduced that this model is a good basis for the study of soft nuclei. Different theoretical calculations in the Os-Hg region have been compared, in particular potential energy surfaces calculated by S. G. Nilsson and with a Constrained Hartree-Fock method. In conclusion, some experimental criteria for shape instability regions, oblate deformation regions and critical nuclei have been proposed. (FR)

18597 (LBL-3434) ANALYSIS OF HIGH ENERGY HEAVY-ION TRANSFER REACTIONS. Scott, D. K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1974. Contract W-7405-eng-48. 30p. (CONF-741056-2). Dep. NTIS $4.50.

From symposium on classical and quantum mechanical aspects of heavy ion collisions; Heidelberg, F. R. Germany (2 Oct 1974).

The regions of validity of quantal and semiclassical theories are discussed for high energy transfer reactions with heavy-ions. After demonstrating the equivalence of the two formalisms, they are applied quantitatively to predict spectroscopic factors, the energy dependence and Q dependence of single nucleon transfer on lead. The power of semiclassical theory for making wide surveys is shown. The discovery of simple cluster states in multinucleon transfer reactions on lighter nuclei is discussed using semiclassical theory. Finally the quantal analysis of new effects due to multistep processes in high energy heavy-ion reactions is presented. (auth)

18598 DECAY OF ^{209}Rn. Excited States in ^{209}At. Vylov, Ts.; Golovkov, N. A.; Gromov, K. Ya.; Gromova, I. I.; Kolachkovski, A.; Kuznetsova, M. Ya.; Norseev, Yu. V.; Chumin, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 701-709(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

Data were reported on the energies and intensities of the γ lines and conversion electrons in the decay of ^{209}Rn. The multipolarities of the transitions and the intensities of the γ-γ coincidences were determined. A variant of the decay scheme of ^{209}Rn was proposed including excited states of ^{209}At up to 3700 keV. The value for difference of the mass of ^{209}Rn and ^{209}At was determined experimentally for the first time. This difference was equal to 3928 ± 40 keV. (INIS)

18599 STUDY ON THE DECAY OF ^{191}Tl → ^{191}Hg → ^{191}Au. Vandlik, Ya.; Zajtseva, N. G.; Mateh, Z.; Makhunka, I.; Tyrroff, Kh.; Fenesh, T. (Joint Inst. for Nuclear Research, Dubna (USSR); Magyar Tudomanyos Akademia Atommag Kutato Intezete, Debrecen). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 695-700(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The γ and conversion electron spectra appearing during the decay of ^{191}Tl were measured with Ge(Li) and Si(Li) detectors.

The γ spectra of ^{191}Hg, daughter isotope of ^{191}Tl, was also studied. In the γ spectra of ^{191}Tl, 17 γ transitions were found of which 11 were new. The multipolarities of five transitions and the ϵ/β^+ ratio of ^{191}Tl were determined. On the basis of the study of the γ spectra of ^{191}Hg it was concluded that in addition to the known $^{13}/_2{}^+$ state of ^{191}Hg there exists another long lived (probably ($^3/_2{}^-$) ground) state with half life of 49 ± 10 min. (tr-auth)

18600 THE DECAY SCHEME OF ^{193}Tl. Vandlik, T. B.; Vandlik, Ya.; Zajtseva, N. G.; Mateh, Z.; Makhunka, I.; Makhunka, M.; Tyrroff, Kh.; Fenesh, T.; Fominykh, V. I. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 689-694(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The γ and conversion electron spectra and the γ-γ coincidences were measured with Ge(Li) and Si(Li) detectors for monoisotope preparations of ^{193}Tl. Forty-eight γ transitions were detected, of which 40 were new. The multipolarities of 19 transitions, the half lives, and the ϵ/β^+ ratio were determined. A decay scheme was proposed for ^{193}Tl. (tr-auth)

18601 EMPIRICAL RELATION BETWEEN THE ENERGY OF THE TOPMOST PARTICLE AND THE MEAN BINDING ENERGY OF NUCLEI. Harada, M. (Institute of Liberal Arts, Otaru University of Commerce, Otaru, Hokkaido 047, Japan). Phys. Rev. C 10: No. 6, 2616-2617 (Dec 1974).

On the basis of experimental knowledge, it is shown that separation energy thresholds cannot be interpreted as experimental single−particle energies, and that the energy of the topmost particle in conventional nuclear single−particle potentials is smaller in absolute magnitude than the mean binding energy. Connections with Hugenholtz and Van Hove's theorem are briefly discussed. (auth)

18602 LINEAR MOMENTUM TRANSFER IN REACTIONS BETWEEN 140−MeV ^{4}He IONS AND HEAVY NUCLEI. Viola, V.E. Jr.; Roche, C.T.; Meyer, W.G.; Clark, R.G. (Department of Chemistry, University of Maryland, College Park, Maryland 20742). Phys. Rev. C 10: No. 6, 2416-2424 (Dec 1974).

The fission of ^{238}U, ^{209}Bi, and ^{197}Au induced by 140−MeV ^{4}He ions has been studied in order to investigate the target−projectile reaction mechanism. The fission−fragment angular correlation technique was used to measure the linear momentum transfer in these reactions. It is found that an upper limit of (49.3 ± 4.4) % of the fission in ^{238}U results from the complete fusion of target and projectile. The incomplete fusion component of the ^{238}U fission cross section includes a large fraction of high linear momentum transfer events, presumably produced in reactions where preequilibrium decay and/or deep knockout reactions are highly probable. The fission of ^{197}Au and ^{209}Bi is found to proceed almost completely via a complete fusion mechanism at this energy. The complete fusion cross section for ^{238}U reactions with 140−MeV ^{4}He ions is compared with that predicted from semiclassical collision models derived for heavy-ion reactions. (auth)

18603 RECOIL PROPERTIES OF Ta ISOTOPES PRODUCED IN THE INTERACTION OF HIGH−ENERGY PROTONS WITH Bi AND U. Chang, S.K.; Cheney, M.C.; Sugarman, N. (Enrico Fermi Institute, The University of Chicago, 5630 Ellis Avenue, Chicago, Illinois 60637). Phys. Rev. C 10: No. 6, 2467-2471 (Dec 1974).

Thick−target thick−catcher recoil properties were determined for neutron−deficient Ta isotopes produced in the interaction of 0.45− and 11.5−GeV protons with Bi and U. The production mechanism was shown to be a binary mass division process at 0.45 GeV. At 11.5 GeV, either a high−excitation energy ("deep") spallation process or a fission process from light nuclei is a possible mechanism. The half−life of ^{179}Ta, measured on two samples over a period of two years, was determined to be 588 ± 10 days. (auth)

18604 BLOCKING EFFECT OF THE M1 CORE POLARIZATION STUDIED FROM THE g FACTOR OF THE 8+ STATE IN ^{214}Ra. Yamazaki, Y.; Hashimoto, O.; Ikezoe, H.; Nagamiya, S.; Nakai, K.; Yamazaki, T. (Department of Physics, Faculty of Science, University of Tokyo, Hongo, Bunkyo−ku, Tokyo, Japan). Phys. Rev. Lett. 33: No. 27, 1614-1617 (30 Dec 1974).

The g factor of the 8^+ state of ^{214}Ra($T_{1/2}$=67 μsec) has been determined to be g=0.88±0.01 by the in−beam γ−ray NMR method. The blocking effect of the $[\pi h_{11/2}{}^{-1}\pi h_{9/2}]-1^+$− type core polarization on g factors of $\pi h_{9/2}{}^n$ states is investigated. The observed blocking effect is much less than the theoretical expectation, implying that the correction to the g factor of the $\pi h_{9/2}$ state because of $[\pi h_{11/2}{}^{-1}\pi h_{9/2}]1^+$ excitation is comparable with that because of $[\nu i_{13/2}{}^{-1}\nu i_{11/2}]1^+$. (auth)

18605 NUCLEAR *g* FACTORS OF THE 21/2- AND THE 29/2+ STATES IN ^{211}At. Ingwersen, H.; Klinger, W.; Schatz, G.; Witthuhn, W. (Physikalisches Institut der Universität Erlangen−Nürnberg, Erlangen, Germany). Phys. Rev. C 11: No. 1, 243-252 (Jan 1975).

The g factors of the $21/2^-$ (1416.3 keV, $T_{1/2}$ = 50 nsec) and the $29/2^+$ (2641.2 keV, $T_{1/2}$ = 70 nsec) states in ^{211}At were measured by the time-differential spin rotation method. The experimental results corrected for diamagnetic shielding and Knight shift are $g\,(21/2^-) = +0.917 \pm 0.016$ and $g\,(29/2^+) = +1.073 \pm 0.031$. The analysis yields an orbital g factor of the proton $g_l = 1.12 \pm 0.04$. The comparison with g factors of other $(h_{9/2})^n$ proton states in $N = 126$ isotones shows a significant deviation from the predicted blocking of core polarization. (auth)

18606 EFFECTS OF SPREADING WIDTHS UPON THE DIRECT NUCLEAR REACTION CONTINUUM. Lewis, M.B. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. C 11: No. 1, 145-153 (Jan 1975).

Simple concepts which can be directly applied to measurements of resonances and the accompanying continua have been studied. Pickup reaction spectra leading to hole states in the continuum were found to give an understanding of the excitation energy dependence of resonance damping and the concurrent rise of "background" continuum states. When these hole resonances are parametrized in terms of the shell model, they can be used to predict the energy dependence of the damping of more complex resonances, such as collective particle−hole excitations in the inelastic scattering spectra. Furthermore, it is proposed that part of the background continuum in pickup spectra is the semidirect excitation of the 2h−1p states, the density of which determines both the nuclear damping width and the continuum cross section. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 16123, 18405, 18546−18548, 18555, 18590, 18602, 18603, and 18618.

18607 (BARC-768, pp 63-67) DETERMINATION OF FRAGMENT ISOTOPIC YIELDS IN THE FISSION OF ^{252}Cf ACCOMPANIED BY LIGHT CHARGED PARTICLES. Ajitanand, N. N.; Choudhury, R. K.; Kapoor, S. S. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18608 (BARC-768, pp 67-70) TRAJECTORY CALCULATIONS IN ALPHA-PARTICLE ACCOMPANIED FISSION OF ^{252}Cf. Choudhury, R. K.; Ramamurthy, V. S. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18609 (COO-1162-50) RADIOCHEMICAL STUDIES OF NUCLEAR FISSION AND SEARCH FOR ELEMENT 118 (EKA-RADON). Progress Report, December 1, 1973−December 1, 1974. Wahl, A. C. (Washington Univ., St. Louis, Mo. (USA)). [nd]. Contract AT(11-1)-1162. 22p. Dep. NTIS $4.25.

A long-range program of compilation, evaluation, and correlation of nuclear-charge distribution data was undertaken for a number of fission processes so that improved estimates of independent yields can be made in the future. The major effort this year was directed toward compilation of data for thermal-neutron-induced fission of ^{235}U and toward developing new computer programs for estimating fission product yields and comparing the estimates with the experimental data. Several methods of rapid chemical separation of technetium from molybdenum have been investigated in the presence of Ce(IV) to oxidize low technetium states to TcO_4^-, and one method is in use for determination of the fractional-independent yield of ^{105}Tc from thermal-neutron-induced fission of ^{235}U. Several experiments indicate that the half-life of ^{105}Mo is ~55 s, in agreement with the larger literature values and considerably larger than the 42 s value used in another earlier investigation of the ^{105}Tc fractional-independent yield. Problems with gasket wear during rapid rotation of the beta-recoil "wheel" apparatus led to the design of a new tapered "wheel" apparatus, which is being constructed. Two pieces of equipment to be used in the search for isotopes of element 118 were tested at the Washington University Cyclotron and at the Berkeley SuperHILAC. The efficiencies of emanation of inert-gas atoms from a metal stearate target and of collection and detection of the decay products were determined. A small background of tracks in the polycarbonate detectors was found when uranyl stearate was irradiated with Ar^{+13} ions. Means were devised for measuring the background during an irradiation of uranyl stearate with krypton ions, the next planned irradiation, during which it is hoped to make isotopes of element 118 and to detect, then or later, spontaneous fission of their decay products. (1 figure) (auth)

18610 (JINR−P4-8406) EQUILIBRIUM DEFORMATIONS β_{20} AND β_{40} OF NUCLEI OF THE INITIAL REGION OF ACTI-

NIDES. Ivanova, S. P.; Komov, A. L.; Shirikova, N. Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Equilibrium deformations β_{20}, β_{40} as well as quadrupole and hexadecapole moments of isotopes of Rn, Ra, Th and of light isotopes of U were calculated. The Saxon–Woods potential was used for calculation of the one-particle scheme. (auth)

18611 (JINR–P6-8266) EXISTENCE IN NATURE OF SUPERHEAVY ELEMENTS ACCOMPANYING HAFNIUM. Maslov, O. D.; Popeko, A. G.; Skobelev, N. K.; Ter-Akop'yan, G. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The experiments were performed on a search in nature for superheavy elements accompanying hafnium. It is shown that concentration of these elements in the hafnium samples is at least hundreds of times lower than was declared by the Orsay group. (auth)

18612 (JINR–P7-8357) DETERMINATION OF THE SPONTANEOUSLY FISSIONING ISOMER SPINS. Pham Zui Hien. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

A simple model is suggested for calculation of the spin orientation of the spontaneously fissioning isomers produced in the α-particle reactions. With the help of this model the spins of fissioning isomers are determined from experimental data on the anisotropy of the angular distributions of fragments. (auth)

18613 COMPARISON OF FRAGMENT KINETIC ENERGIES FROM TWO ^{237}Pu FISSION ISOMERS. Bacharach, S.L. (Catholic University of America, Washington, D. C. 20017); Hoeper, P.S.; Morrissey, J.A.; Temperley, J.K. Phys. Rev. C 10: No. 6, 2636-2640 (Dec 1974).

Fission fragment kinetic energy distributions have been measured separately for two spontaneously fissioning isomers of ^{237}Pu produced by the ^{237}Np(d,2n)^{237}Pu^{m} reaction at 13 MeV. Single fragment peak-to-valley ratios and heavy- and light-fragment peak positions were measured for each of the two isomers. Average fragment kinetic energies for each isomer were calculated and compared. Values of isomeric fission half–life are reported with increased accuracy. (auth)

18614 HAUSER–FESHBACH CALCULATION OF THE ^{252}Cf SPONTANEOUS–FISSION NEUTRON SPECTRUM. Browne, J.C.; Dietrich, F.S. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. C 10: No. 6, 2545-2549 (Dec 1974).

The neutron spectrum from ^{252}Cf spontaneous fission has been calculated using the Hauser–Feshbach formalism. Details of the excitation energy and spin distributions have been included for 40 fission fragments chosen in a manner to average over the mass distribution and over pairing–energy effects. No arbitrary parameters were introduced into the calculation to produce a fit to the data. The results of the calculation are in good agreement with experimental data. (auth)

18615 DELAYED GAMMA RAYS FROM FISSION INDUCED BY 13.3-MeV PROTONS ON ^{232}Th, ^{235}U AND NATURAL URANIUM. Calboreanu, A.; Cincu, E.; Manzatu, I.; Pencea, C.; Salagean, O. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 6, 629-641(1974).

The delayed gamma rays emitted by fission products, with half-lives from minutes to tens of hours, in proton induced fission on ^{232}Th, ^{235}U and natural uranium were studied using Ge (Li) spectrometry. A number of 23 gamma rays belonging to 17 isobaric chains were identified. From the gamma spectra corresponding to the three fissionable targets, irradiated and measured in identical conditions, a number of 12 gamma lines were selected and their relative intensities compared. During the temporal evolution of a certain specified gamma ray, its real intensity may be more or less distorted by other gamma rays, with close energies, but different half-lives. In other to establish the appropriate moment of measurement, i.e. the time interval when the contaminating contribution is minimum, a method of optimization is outlined. (auth)

18616 POST-FISSION PHENOMENA. Hoffman, D. C.; Hoffman, M. M. (Los Alamos Scientific Lab., NM). Annu. Rev. Nucl. Sci.; 24: 151-207(1974).

Post-fission phenomena are those occurring after scission of the fissile nuclide into two fragments of roughly equal mass. This review includes studies of the resulting distribution of mass, charge, and kinetic energy between the fragments and the prompt emission of neutrons and photons from the fragments; it does not include what happens before or during scission except as such information can be deduced from post-fission studies. The above topics are subdivided as follows: mass distributions and yields (methods of measurement; dependence of fission species and excitation energy; low-energy fission: general, fission isomers, ternary fission; medium-energy fission; high-energy fission; fission induced by complex projectiles; comparison with theory), charge distributions (methods of measurement; low- and medium-energy fission; high-energy fission), kinetic energy distributions (variation with fissioning species; fragment kinetic energy as a function of mass and charge; dependence on excitation energy and angular momentum), neutron emission (introduction; methods of measurement; average number and multiplicity; energy spectrum; dependence on mass, charge, kinetic energy, and excitation energy), and photon emission (energy spectrum; total energy and multiplicity; angular distribution; time dependence and spectroscopy). A brief summary concludes the review. (19 figures, 2 tables, 227 references) (RWR)

Nuclear Theory

Refer also to abstracts 18245, 18284, 18328, and 18562.

18617 (BARC-768, pp 58-59) EFFECT OF SHORT RANGE CORRELATION ON THE (p,2p) REACTION. Jain, B. K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18618 (BARC-768, pp 71-73) ENTROPY METHOD FOR OBTAINING RELATIVE SHELL CORRECTION ENERGIES OF NUCLEI. Ramamurthy, V. S.; Kapoor, S. S. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

18619 (BNL-19359) MANY BODY APPROACH TO THE LOW ENERGY PION–NUCLEUS INTERACTION. Dover, C. B. (Brookhaven National Lab., Upton, N. Y. (USA)). Sep 1974. 49p. (CONF-740947-1). Dep. NTIS $5.50.

From American Ceramic Society meeting; Williamsburg, Virginia, USA (29 Sep 1974).

The treatment of low energy pion reactions with nuclei at 0 to 100 MeV covers the theoretical framework and density and hole line expansions. (JFP)

18620 (COO-3235-55) NUCLEAR EXCITATIONS AND REACTION MECHANISMS. Progress Report, February 1, 1974–October 31, 1974. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). 1 Nov 1974. Contract AT(11-1)-3235. 31p. Dep. NTIS $4.75.

Theoretical research on nuclear excitations and reaction mechanisms is summarized. A list of publications is included. (JFP)

18621 (IC–73-14) ALPHA DECAY AS A WEAK INTERACTION. Barut, A. O.; Sevgen, A. (International Centre for Theoretical Physics, Trieste (Italy)). Feb 1973. 13p. INIS.

Alpha decay is considered as a weak interaction and coupling constants g^2 for various decays are extracted. The values of g^2 show large variations. The alpha decay mechanism from nuclear physics is used to extract from g^2 a smoothly varying factor and a penetration factor. The large variation is attributed to the large values and variations of the charges of nuclei. Possible applications to the mechanism of the beta decay are discussed. (auth)

18622 (INR-1427/7/PL) SPIN AND SPIN–ISOSPIN SYMMETRY ENERGY OF NUCLEAR MATTER. Dabrowski, J.; Haensel, P. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 29p. INIS.

The expression, $E/A = \epsilon_{vol} + \frac{1}{2}\epsilon_{\tau}\,\alpha_{\tau}^{2} + \frac{1}{2}\epsilon_{\sigma}(\alpha_{n} + \alpha_{p})^{2} + \frac{1}{2}\epsilon_{\sigma\tau}(\alpha_{n} - \alpha_{p})^{2}$, for the ground state energy of nuclear matter with an excess of neutrons, of spin-up neutrons, and of spin-up protons (characterized by the corresponding parameters, $\alpha_{\tau} = (N-Z)/A$, $\alpha_{n} = (N_{\uparrow} - N_{\downarrow})/A$, and $\alpha_{p} = (Z_{\uparrow} - Z_{\downarrow})/A$) contains three symmetry energies: the isospin symmetry energy ϵ_{τ}, the spin symmetry energy ϵ_{σ}, and the spin-isospin symmetry energy $\epsilon_{\sigma\tau}$. General expressions for ϵ_{σ} and $\epsilon_{\sigma\tau}$ are obtained with the help of the K-matrix which depends on four different Fermi momenta. With suitable approximations, numerical values of ϵ_{σ} and $\epsilon_{\sigma\tau}$ (and also of ϵ_{τ}) are obtained with the help of the Brueckner–Gammel–Thaler, the Hamada–Johnston, and the Reid soft core nucleon-nucleon potential. The most reliable results, obtained with the Reid soft core potential, are: $\epsilon_{\tau} = 61$ MeV, $\epsilon_{\sigma} = 74$ MeV, $\epsilon_{\sigma\tau} = 73$ MeV. The possibility of estimating the energies of the spin and spin-isospin modes of collective nuclear excitations is discussed. (auth)

18623 (INR–1438/7/PL) SPIN AND ISOSPIN DEPENDENCE OF THE SINGLE-PARTICLE POTENTIAL IN NUCLEAR MATTER.

Dabrowski, J.; Haensel, P. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 13p. INIS.

The spin and isospin dependent parts of the single-particle potential in nuclear matter are calculated at the Fermi surface with the Brueckner–Gammel–Thaler and the Reid soft core potential. The spin-spin part of the optical model potential is estimated. The rearrangement effects turn out to be very important. (auth)

18624 (ITEF–93) STUDY ON THE $\pi^+ + n(A) \rightarrow p + \pi^0 + A^1$ REACTION ON CARBON AND XENON NUCLEI AT 2.9 GeV/c. Vorob'ev, I. I.; Novikov, L. S.; Shishov, N. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 23p. (In Russian). INIS.

The charge-transfer reaction of π^+-mesons on nuclei of carbon and xenon: $\pi^+ + n(A) \rightarrow p + \pi^0 + A'$ at a momentum of 2.9 GeV/c is investigated, and the interactions which take place on a single, weakly bound nucleon of the nucleus are separated out. Consideration is given to distributions in the excitation energy of the nucleus, the momentum of the nucleus, the squares of the 4-fold momenta transmitted to the proton and nucleus, the mass of the $p\pi^0$ system and the deficient mass to the π^0-meson. These distributions agree with the concept of an interaction of π^+-mesons with a single nucleon of the nucleus. Two-dimensional distributions of the momentum-angle emission of secondary particles of the π^0-meson and of the proton are considered. The angle of proton emission in a number of cases differs substantially from the expected angle for reaction on a free nucleon. The assumption of neutron motion in the nucleus with a momentum up to 200 MeV/c also does not explain the emission angle of a proton in a number of cases. The distribution in the angle of Treiman-Yang and in the emission angle of the nucleus shows that cases having a momentum of the nucleus <200 MeV/c meet the criteria of the pole diagram. The ratio of the above reaction and of an analogous reaction where a η (2γ)-meson is formed was found to be equal to 4.8 ± 1.2. (tr-SJR)

18625 (JINR-P4-8206) APPLICATION OF MODEL FOR DESCRIPTION OF STRUCTURE OF HIGHLY EXCITED STATES OF DEFORMED NUCLEI TO THE CASE OF A WAVE FUNCTION CONTAINING A THREE-PHONON COMPONENT. Malov, L. A.; Nesterenko, V. O. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

An approximate analytical solution for energies and wave functions of highly excited rotational states of odd-mass deformed nuclei within the framework of semi-microscopic model is derived for description of highly excited states of deformed nuclei. The wave function contains a component of a quasiparticle plus three phonons. (auth)

18626 (JINR-P4-8208) TRANSLATIONAL INVARIANCE AND EFFECTIVE FORCE. Pyatov, N. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

An approximate method of constructing the effective force in order to restore the violated symmetry of the one-particle Hamiltonian is formulated. The effective force is sought in a separable form. Its radial dependence and the strength are associated with the nuclear potential and the energy-weighted sum rule for the integral of motion in question. The method is applied to study the effective force restoring translational invariance. The cases of anisotropic harmonic oscillator potential and the spherical Saxon-Woods potential are considered. The effective force is found to be of the dipole type. For the realistic nuclear potential the effective force is essentially a surface-peaked one. The case of arbitrary nuclear potential is considered in RPA. The center-of-mass motion is explicitly eliminated and the equation for the energy of I^- excitations is obtained. (auth)

18627 (JINR-P4-8380) PRINCIPLE OF INVARIANCE AND EFFECTIVE FORCES. Pyatov, N. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The one-particle (quasiparticle) Hamiltonian H^0 always possesses some kind of broken symmetry thus violating the corresponding conservation laws or selection rules. The restoration of broken symmetry can be achieved by taking into account the particle (quasiparticle) correlations. A method for constructing effective separable forces h is constructed proceeding from the conservation law for a given additive integral of motion F. In RPA these forces contain no arbitrary parameters thus allowing for an explicit elimination of the Goldstone gapless branch ("spurious" state) of collective excitations. It is found that effective forces h always contain the term which cancels in harmonic approximation the "localizing" potential in H^0. This potential removes the degeneration of the many-body states with respect to collective coordinate ϕ conjugate to the integral of motion. The rigidity γ of the "localizing" potential and the mass parameter j_0 are defined as the energy-weighted sum rules for F and ϕ, respectively. The frequency ω_ϕ of harmonic oscillations of the static symmetry-breaking field is connected with those parameters. The estimates of γ, j_0 and ω_ϕ are given for some cases of broken symmetry. (auth)

18628 (JINR–P4-8417) MODEX: THE PROGRAM FOR CALCULATION OF THE ENERGY SPECTRA OF PARTICLES EMITTED IN THE REACTIONS OF PRE-EQUILIBRIUM AND EQUILIBRIUM STATISTICAL DECAYS. Mashnik, S. G.; Toneev, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 27p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The program is described intended for calculation of the energy distribution of particles, emitted by an excited nucleus, using the modified exiton model. The complete text of the program is presented in FORTRAN language. (auth)

18629 (LBL-3363) ROTATING, CHARGED OR GRAVITATING LIQUID DROP, AND PROBLEMS IN NUCLEAR PHYSICS AND ASTRONOMY. Swiatecki, W. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 29p. (CONF-740837-4). Dep. NTIS $4.50.

From international colloquium on drops and bubbles; Pasadena, California, USA (28 Aug 1974).

A survey is presented of the equilibrium configurations of a rotating charged or gravitating liquid mass in a way that unifies the treatment of idealized rotating heavenly bodies, rotating drops in a weightless environment, and idealized rotating nuclei. A number of applications, especially to nuclear physics, is described. (auth)

18630 CONNECTION OF VIBRATIONAL AND QUASI-PARTICLE STATES IN THE RANDOM PHASE METHOD FOR EVEN-EVEN SPHERICAL NUCLEI. Mitroshin, V. E. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 811-821(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

Within the framework of the random phase method, the Hamiltonian of the interaction of vibrational and quasi-particle motion was constructed. On the basis of the Hamiltonian obtained, the phenomenological two-parameter model describing the energy spectra of even-even nuclei in the region of closed shells, the probability of γ transitions, and the quadrupole moment of the 2_1^+ level were examined. The proposed description was compared with experimental values. (tr-auth)

18631 STUDY ON THE NUCLEON STRUCTURE EFFECT ON THE NUCLEAR MATTER PROPERTIES. Dzhavadov, A. V.; Tveretskij, A. P. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 825-830(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The ground state of nuclear matter was studied under the assumption of the existence of a rigid core of radius r_c. The two-nucleon potential was expressed in the form of sums of the forces of the Serber central type and the Heisenberg spin type. An expression was obtained for the energy for the bonding of the nuclear matter to the nucleon. (tr-auth)

18632 SUM RULE FOR THE SECOND MOMENT OF THE RESPONSE FUNCTION IN ELECTRON–NUCLEI SCATTERING. Inopin, E. V.; Roshchupkin, S. N. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 9, 1543-1548(Sep 1974). (In Russian).

The sum rule is obtained for the second moment of the response function with taking into account an exchange part of the nucleon-nucleon potential. The sum rule is shown to be characterized by the Fourier-component of the nuclear current as well as by value describing the exchange part of NN-potential. It is found, that the exchange correction may be significant. The results obtained are in good agreement with the experimental data. (auth)

18633 ACCOUNT OF CORRELATIONS IN PHOTOPRODUCTION OF CHARGED PIONS FROM NUCLEI AT HIGH ENERGIES. Gevorkyan, S. R.; Matinyan, S. G.; Solakhyan, V. P. (Inst. of Physics, Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 4, 277-283(1974). (In Russian).

The contribution of dynamical correlations to cross sections of charged pions photoproduction on atomic nuclei was investigated in the framework of Glauber theory. It is shown, that the main contribution to the cross section of process under consideration comes from correlations between nucleons on which the photoproduction or elastic scattering take place. The effect under consideration makes 5 to 10%. (auth)

18634 MICROSCOPIC THEORY OF THE INTERMEDIATE STRUCTURE OF GIANT RESONANCES IN NUCLEAR REACTIONS. Zhivopistsev, F. A.; Lukashev, A. V. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 849-854(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

One of the possible variants of the microscopic theory of highly excited collective states ($J^{\pi} = 1'$, $T_{<}$, ($T_{>}$)) was examined with consideration of the relation with very complex excitations (2p2h type). (tr-auth)

18635 ISOTOPIC SPIN CONSERVATION AND BETA DECAY OF SPHERICAL NUCLEI. $1f_{7/2}$ Shell. Nersesov, Eh. A. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 831-839(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

On the basis of the theory of the finite Fermi system, a calculation was made of the size of the matrix elements of the isotopic-spin forbidden Fermi β transitions. The calculated values of the theoretical evaluation for these matrix elements were compared with experimental data for a series of β transitions in the region of the filling of the $1f_{7/2}$ shell. (tr-auth)

18636 LIMITATION ON COMPLETE FUSION DURING HEAVY—ION COLLISIONS. Glas, D. (Institut für Theoretische Physik, Universität Giessen, 63 Giessen, Germany); Mosel, U. Phys. Rev. C 10: No. 6, 2620-2622 (Dec 1974).

In a recent paper Lefort and collaborators have extracted a critical distance of approach as the mechanism limiting fusion of two heavy ions. In this comment it is shown that this analysis does not depend on the specific model used for the calculation of the ion—ion potential. Furthermore, an expression is derived to analyze both high— and low—energy fusion data on the same basis. It is concluded that all existing data are compatible with the existence of a critical distance. However, data spanning a larger range of energies and being more accurate at high energies are needed for a final check of the critical distance hypothesis. (auth)

18637 DISTORTED—WAVE THEORY OF MULTISTEP PROCESSES: A REPLY. Robson, D. (Physics Department, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 10: No. 6, 2626 (Dec 1974).

The conclusions reached by Austern and Vincent concerning the role of creativity in second-order processes are argued to arise from a misinterpretation of earlier work by D. Robson. (auth)

18638 PION—NUCLEUS CHARGE EXCHANGE REACTIONS IN THE ISOBAR—DOORWAY MODEL. Nagarajan, M.A.; Wang, W.L. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. C 10: No. 6, 2125-2134 (Dec 1974).

The isobar—doorway model, previously applied to the study of pion—nucleus elastic scatterings, is generalized to the treatment of single and double charge exchange reactions. The charge exchange amplitudes are calculated within the framework of distorted—wave Born approximation, where the resonant distortion of the elastic scattering wave functions in the initial and final channels as well as the resonant part of the charge exchange interaction are explicitly taken into account. In the isobar—doorway model, it is shown that the transition amplitude depends upon quantities related to the elastic scattering and to a charge exchange amplitude which contains nonresonant initial and final pion wave functions. The strong energy dependence in various components of single and double charge exchange amplitudes is clearly displayed in the model; this energy dependence due to the (3,3) isobar in the reaction mechanism (including initial— and final—state interactions) may also be separated out from the nuclear structure information as contained in the nuclear form factors. This separation is obtained through the static and the closure approximations which are in the isobar—doorway model. (auth)

18639 EXTENSION OF THE EFFECTIVE RANGE THEORY OFF THE ENERGY SHELL. Ernst, D.J.; Shakin, C.M.; Thaler, R.M. (Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106). Phys. Rev. C 10: No. 6, 2176-2183 (Dec 1974).

The effective range theory is generalized. The leading terms in the expansion of the off—shell K matrix, $\langle p|K(s^2)|q\rangle$, about its value at a point $p = q = q_0$, $s = s_0$, are expressed in terms of the off—shell wave functions which are solutions of the "off—shell" Lippmann—Schwinger equation. It is shown that this procedure gives the usual effective range result in the case that $q_0 = s_0$. The simplification which occurs for an expansion about an on—shell point is discussed. The necessary modifications introduced by energy-dependent interactions are also given. (auth)

18640 OFF—SHELL T MATRICES FOR A CLASS OF SEPARABLE NONLOCAL POTENTIALS. Bagchi, B.; Mulligan, B. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. C 10: No. 6, 2197-2205 (Dec 1974).

In an earlier paper we considered scattering of all partial waves from a wide class of separable nonlocal potentials, and obtained in configuration space exact analytic solutions for the wave functions and phase shifts. In this paper these solutions are used to construct exact expressions for the half—off—shell and off—shell T matrices for this class of potentials. As an illustration, we compare the off—shell T matrix for the one—term Yamaguchi potential calculated by the method presented here with the expression obtained by standard techniques. (auth)

18641 SEPARABLE EXPANSION FOR THE NUCLEAR FORM FACTORS. Nagarajan, M.A.; Wang, W.L. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. C 10: No. 6, 2206-2209 (Dec 1974).

We apply the techniques of the Fourier—Bessel series to obtain a separable expansion of the (local) nuclear form factors in the momentum space. The accuracy of the expansion is studied for a Woods—Saxon and a derivative Woods—Saxon density distribution. The technique will be useful in many nuclear scattering calculations. (auth)

18642 CONTRIBUTIONS TO THE NUCLEON—NUCLEON INTERACTION DETERMINED FROM $\pi-\pi$ PHASE SHIFTS. Riewe, F.E.; Nack, M.L.; Green, A.E.S. (University of Florida, Gainesville, Florida 32611). Phys. Rev. C 10: No. 6, 2210-2214 (Dec 1974).

A nonrelativistic description of the nucleon—nucleon interaction is presented which uses only currently known mesons. The model differs from previous ones in that it uses realistic potentials with all parameters determined directly from experiment except the coupling constants and form—factor parameters. Dipole form factors are used to describe all meson—nucleon interactions. The generalized one—boson—exchange potential utilizes the π, η, ω, and δ mesons, and the resonances extracted from the δ^0_0 and δ^1_1 $\pi-\pi$ phase shift (δ^1_1) data. The π, η, ω, and δ are represented by zero—width propagators, where we assume their spectral functions or mass squared distributions are approximated by $\delta(m^2-m_r^2)$ for a particle of mass m_r. The detailed prescription of Nack, Ueda, and Green is used for obtaining spectral functions from δ^0_0 and δ^1_1 and their corresponding finite width propagators. Three δ^0_0 solutions are considered—the ϵ up solution, ϵ down solution, and the S^*. Both the Baton and Scharenguivel solutions for δ^1_1 are considered for the ρ. Fitting the models to N—N phase—shift data indicates a slight preference for the ϵ down solution, but does not differentiate between solutions for the ρ. (auth)

18643 COMPARISON OF METHODS OF SCATTERING FROM TWO POTENTIALS. Gibbs, W.R. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Rev. C 10: No. 6, 2166-2173 (Dec 1974).

Several approximations to multiple scattering are compared with an exact calculation. The model chosen for comparison is scattering from two Gaussian potentials of range 0.5 fm and depth 16 fm^{-2}. Particular attention is paid to the case of overlapping potentials. It is shown that, of all approximations considered, only the separable potential method is capable of giving good agreement in this region. It is demonstrated that a separable potential can always be chosen to give the exact answer for multiple scattering in the case in which the (spherically symmetric) interaction regions are nonoverlapping as well as when the interaction regions are concentric. (auth)

18644 EXTENSION OF THE ISOBAR MODEL FOR INTRANUCLEAR CASCADES TO 1 GeV. Harp, G.D. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 10: No. 6, 2387-2396 (Dec 1974).

An intranuclear cascade model is proposed for studying pion- and nucleon-induced reactions in the region of single pion production. The model explicitly considers the production and subsequent interactions of (3,3) isobars. The predictions of the model are compared with experimental data from proton-induced reactions such as pion production yields, pion and proton energy and angular distributions, and spallation yields. The model gives a fair to excellent representation of all these data. (auth)

18645 RENORMALIZED BRUECKNER—HARTREE—FOCK AND DENSITY DEPENDENT HARTREE—FOCK THEORIES OF FINITE NUCLEI. Davies, K.T.R. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544 and Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); McCarthy, R.J.; Negele, J.W.; Sauer, P.U. Phys. Rev. C 10: No. 6, 2607-2612 (Dec 1974).

Renormalized Brueckner—Hartree—Fock and density-dependent Hartree—Fock calculations in the literature have been difficult to compare because they involve both different physical approximations and also technical computational differences. Hence, results obtained in both calculations for ^{40}Ca are corrected for technical differences and compared in detail. It is shown that comparable Brueckner—Hartree—Fock calculations using an oscillator basis and using the local density approximation are in good numerical agreement, and that three mechanisms are of roughly equal importance in obtaining the proper interior density occupation probabilities, the potential arising from the variation of the Pauli operator, and the phenomenological parametrization of higher-order corrections to the effective nuclear interaction. The renormalized-oscillator-basis calculations include only the effect of occupation probability diagrams. The "bare" local density approximation results are an improvement over the renormalized results since the former includes the effects of both occupation probabilities and the variation of the Pauli operator. The adjusted local-density-approximation calculations then give further improvement due to the phenomenological parametrization of the force, simulating the effect of higher—order diagrams. (auth)

18646 NUCLEAR MATTER RESULTS FOR THE FESHBACH—LOMON INTERACTION. Lomon, E.L. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts). Phys. Rev. C 10: No. 6, 2584-2606 (Dec 1974).

It is shown that the internal boundary condition (of the Feshbach—Lomon interaction), which has no effect on the two-nucleon wave function, has a large effect on the saturation properties of nuclear matter. The binding energy per particle is altered over a range of approximately 30 MeV. The saturation density can be varied while the binding energy is kept fixed by correlated changes of the spin—spin, tensor, and central parts of the internal boundary condition. In this way the nuclear parameters are fitted without altering the good fit of the Feshbach—Lomon interaction to the two-body data. The nuclear matter calculation is performed by matrix inversion of a Bethe—Goldstone equation which has been suitably modified to impose the external and internal boundary conditions. A self—consistent hole spectrum is used. A free-particle spectrum is used for most of the results. The effect of a single-particle potential of the strength that would cancel three—body cluster contributions is investigated, and found to be of marginal importance for the boundary condition-type interaction, and insensitive to the potential strength. Best nuclear matter internal parameters are close to the S—state pair superfluidity threshold, implying pairing effects in the nuclear surface and neutron stars. (auth)

18647 DISTORTED—WAVE THEORY OF MULTISTEP PROCESSES. Austern, N.; Vincent, C.M. (Physics Department, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. C 10: No. 6, 2623-2625 (Dec 1974).

Robson's criticism of the distorted—wave Green's function, used for intermediate states in higher—order calculations, is examined and shown to be unfounded. Possible difficulties of his suggested alternative method for higher—order calculations are considered. (auth)

18648 LIPKIN—NOGAMI APPROXIMATION OF PAIRING INTERACTION. Ng, W.Y.; Castel, B. (Physics Department, Queen's University, Kingston, Canada). Phys. Rev. C 10: No. 6, 2643-2645 (Dec 1974).

It is shown that the condition used in the Lipkin—Nogami method of suppressing number fluctuations in pairing interaction is not unique. Two other possible conditions are suggested and applied to three exactly solvable models to illustrate that these conditions are model dependent. (auth)

18649 NUCLEAR CHARGE FORM FACTOR WITH INTRINSIC HYPERSPHERICAL—COORDINATE WAVE FUNCTIONS. Sotona, M.; Žofka, J. (Institute of Nuclear Physics, Czechoslovak Academy of Sciences, Řež—Prague, Czechoslovakia). Phys. Rev. C 10: No. 6, 2646-2648 (Dec 1974).

A simple expression for the intrinsic form factor of magic nuclei in the lowest-order approximation of the hyperspherical—coordinate method is derived, discussed, and applied to ^{16}O and ^{4}He. A good agreement with experimental values for $q^2 \lesssim 8$ fm^{-2} and the appearance of a dip in the form factor of ^{4}He are noticed. (auth)

18650 CHARGE REDISTRIBUTION OF THE NUCLEUS DURING EXCITATION. Dautov, L. M.; Kaipov, D. K. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 4, 67-68(1974). (In Russian).

The redistribution of the charge of the nucleus during excitation was studied from the isomeric displacement of the x-ray lines. The experimental conditions were: a nuclear transition (electron capture or internal electron conversion) creating holes in the electron shell precedes the settlement of the level studied; the lifetime of the nuclear state is higher than the lifetime of the primary electron hole $\sim 10^{-18}$ sec; the isomeric displacement of the x-ray lines exceeds the measurement error. A wide class of nuclear levels, primarily by the Moessbauer effect, satisfy the first two conditions. The third condition is achieved even for some of the Moessbauer levels if the experiments are made on apparatus used at the present for measurement of the isotopic displacement of x-ray lines. These conditions limit the energy and lifetimes of the nuclear levels only below $E_0 \gtrsim 0.1$ MeV, $\tau > 10^{-16}$ sec, i.e., in new experiments it is possible to study excited nuclear states unusable for the Moessbauer effect. (tr-auth)

18651 EKSPERIMENTAL'NAYA YADERNAYA FIZIKA. Tom I. Fizika Atomnogo Yadra. (Experimental Nuclear Physics. Volume I. Physics of Atomic Nuclei). Mukhin, K. N. Moscow; Atomizdat (1974). 584p.

A textbook, completely revised for the fourth edition in a series on introduction to nuclear physics, is presented. The book is characterized by its complete and detailed discussion of the materials of contemporary experimental nuclear physics. The book is based on a series of lectures presented to the department of experimental and theoretical physics of the Moscow Engineering-Physics Institute. The properties of stable nuclei, nuclear models, α and β decay, γ radiation, passage of particles and radiation through matter, principles of neutron physics and fission physics, and nuclear reactions are considered in Volume I. (tr-auth)

18652 SCATTERING OF HEAVY IONS AT LOW ENERGY IN THE FRAMEWORK OF MOLECULAR ORBITALS. Becker, F.; Joffily, S.; Beccaria, C.; Baron, G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 22: No. 1, 3-63(1974).

A generalization of the model of nuclear reactions proposed by W. Von Oertzen is given in the framework of molecular orbitals. The different equations leading to the cross section are derived and discussed. It turns out that the helicity scheme is the most appropriate one. Some emphasis is given to reactions including elastic scattering and elastic transfer for which this approach is well suited. Both the unadiabatic and Coriolis coupling terms which appear in the equations are discussed, and is shown how these terms are partly cancelled if one takes into account one part of the recoil effect. (auth)

18653 ALPHA DECAY OF SHAPE ISOMERS. Dorobantu, I. A.; Sandulescu, A. (Inst. of Atomic Physics, Burcharest). Rev. Roum. Phys.; 19: No. 8, 805-821(1974).

The alpha decay of shape isomers is studied. This implies favored alpha transitions in deformed nuclei with different deformations. By using the Dyson transform and BCS wave functions for deformed nuclei, explicit expressions are obtained for the matrix elements which appear in favored alpha transitions of even and odd mass nuclei, with different deformations. No zero point oscillations are considered. The result is given in terms of Nilsson expansion coefficients and supports the usual expression for equal deformations. (auth)

18654 RELATIVISTIC EFFECTS IN PHENOMENOLOGICAL NUCLEON—NUCLEON POTENTIALS AND NUCLEAR MATTER. Coester, F.; Pieper, S.C.; Serduke, F.J.D. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. C 11: No. 1, 1-18 (Jan 1975).

For any conventional phenomenological nucleon—nucleon potential, we derive a relativistic two—body Hamiltonian. With this two—body Hamiltonian we construct an approximately relativistic many—body Hamiltonian that is used to find the lowest-order relativistic corrections to the Brueckner theory of nuclear matter. These corrections are explicitly presented as a sum of terms that are linear and quadratic functions of the nonrelativistic reaction matrix. Numerical results are obtained for the Reid soft-core potential, the Ueda—Green potential, and several separable potentials. Due to extensive cancellations of the individual terms, the total correction is considerably smaller than that which would be expected from simple estimates. For the Reid potential the total correction to the energy per particle at saturation is only +0.22 MeV, and the change in the saturation density is negligible. The correction at saturation is also positive for all the other potentials considered. (auth)

18655 SYMMETRY COEFFICIENT AND THE ISOSPIN—SPIN DEPENDENCE OF THE SINGLE—PARTICLE POTENTIAL. Khanna, K.M.; Barhai, P.K. (Department of Applied Physics, Birla Institute of Technology, Mesra, Ranchi, India). Phys. Rev. C 11: No. 1, 264-265 (Jan 1975).

The symmetry coefficient a_τ for nuclear matter with a given neutron excess has been calculated within the framework of the independent particle model using two effective interactions determined in an earlier paper. The interactions referred to as Set 1 and Set 2 have been found to give $a_\tau = 44.89$ MeV and $a_\tau = 43.16$ MeV, respectively. The isospin—spin dependent part of the single—particle potential U_1 has also been estimated using an explicit expression due to Brueckner and Dabrowski. The corresponding values of $U_1(k_F)$ are 158.48 and 102.64 MeV for the interactions of Set 1 and Set 2, respectively. These values of a_r and $U_1(k_F)$ compare reasonably well with those obtained by others. (auth)

18656 NEW COUPLED—REACTION—CHANNELS FORMALISM FOR NUCLEAR REACTIONS. Tobocman, W. (Physics Department, Case Western Reserve University, Cleveland, Ohio 44106). Phys. Rev. C 11: No. 1, 43-49 (Jan 1975).

A set of coupled integral equations (CIE) for multichannel nuclear reactions is considered which appears to have some advantages over the conventional coupled—reaction—channel (CRC) equations when transfer channels must be included. Both the CIE and CRC formalisms are based on the assumption that the system has a limited number of cluster-type intermediate states available to it. The CIE have a connected kernel while those of the CRC do not. In addition, the troublesome nonorthoganality terms of the CRC formalism have no counterpart in the CIE formalism. The CIE are compared with those of the CRC formalism. The CIE for a simple model for deuteron scattering from a structureless target are presented as an explicit example. (auth)

18657 JOST FUNCTION FOR COUPLED PARTIAL WAVES OF THE REID SOFT—CORE POTENTIAL. Sasakawa, T. (Department of Physics, Tohoku University, 980—Sendai, Japan); Sawada, T. Phys. Rev. C 11: No. 1, 87-89 (Jan 1975).

It is pointed out that the usual expression of the scattering amplitude of the Jost matrix can be used to the states coupled by the potential with $1/r$ singularity, as well as less singular couplings. The expression is useful for practical numerical calculations. (auth)

18658 NUCLEAR VISCOSITY. Giraud, B.; Le Tourneux, J.; Osnes, E. (Service de Physique Théorique, Centre d'Etudes Nucléaires de Saclay, BP No. 2—91190 Gif—sur—Yvette, France). Phys. Rev. C 11: No. 1, 82-86 (Jan 1975).

The decay rate of momentum in a nuclear reaction is given by an exact formula expressed in terms of the T matrix. A special case, where a viscosity coefficient can be estimated, is considered. (auth)

18659 REACTIONS BETWEEN MEDIUM AND HEAVY NUCLEI AND HEAVY IONS OF LESS THAN 15 MeV/amu. Fleury, A. (Centre d'Etudes Nucleaires de Bordeaux-Gradignan, France); Alexander, J. M. Annu. Rev. Nucl. Sci.; 24: 279-339(1974).

The emphasis of this review is on reaction mechanisms involving medium and heavy nuclei and the properties of composite systems at the time of collision. The purpose is to give an overview of the various reaction studies and the interfaces between them. First, some typical experimental observations are given and related to the classical deflection function; then the various reactions are considered in somewhat more detail in order of increasing complexity. After a treatment of classical trajectories and cross sections in the introduction, the review is organized under the following headings: Elastic scattering and total reaction cross sections: parametrization of phase shifts (sharp cutoff model, smooth cutoff models), optical model, total reaction cross sections; reactions involving soft collisions (those with small transfers of energy or mass): reaction models and inelastic scattering, soft or quasi-elastic transfer reactions, most probable Q values (Q_{opt}); reactions involving hard collisions (those with substantial mass and/or energy transfer and asymmetric angular distributions): the trajectories of approach and separation, the distribution of mass and charge, proposals concerning the reaction mechanisms (entrance and exit channels, energy distributions, yield distributions); and reactions involving fusion collisions: complete fusion cross section, rates of decay and the density of states, experimental studies. (27 figures, 172 references) (RWR)

18660 TIME DESCRIPTION OF NUCLEAR REACTIONS. Yoshida, S. (Rutgers—The State Univ., New Brunswick, NJ). Annu. Rev. Nucl. Sci.; 24: 1-33(1974).

Work connected with time-dependent experiments is reviewed; in this type of experiment the time-dependent behavior of nuclear reactions is observed by measuring the intensity of outgoing particles as a function of the time elapsed since the formation of the compound nucleus. To study time-dependent behavior one starts from the time-dependent description of scattering and reactions using a wave packet; this description is briefly reviewed, and the time delay is also discussed. Then the decay of an isolated resonance state is considered, including the exponential decay law and deviations from it. Next, nuclear reactions involving many levels are treated—in this situation the statistical theory is applicable. It is first assumed, perhaps unrealistically, that the time duration of the wave packet is much shorter than the lifetime. Then more realistic experiments are considered. After a discussion of an early attempt to measure a fast lifetime, the main topics concern the recently developed crystal blocking experiments. It is shown how it is possible to measure short lifetimes by using wave packets with a longer time duration. Information which can be obtained from this type of experiment is discussed. Finally, some experimental data in connection with an intermediate resonance are reviewed. The treatment is restricted to reactions induced by particles of rather low energy. (4 figures, 1 table, 66 references) (RWR)

18661 RULE FOR THE SPINS OF THE LOWEST STATE WITH $T = |T_Z|$ OF DOUBLY ODD NUCLEI HAVING j^n CONFIGURATION. Gupta, S.K. (Van de Graaff Laboratory, Nuclear Physics Division, Bhabha Atomic Research Centre, Trombay, Bombay—85., India). Phys. Rev. C 11: No. 1, 259-261 (Jan 1975).

Two empirical rules given earlier have been modified to one rule for the spins of the lowest state with $T = |T_Z|$ for the odd—odd nuclei where the valence nucleons are filling the same subshell. The recent measurement on $^{22}{}_{9}$F follows the new rule. Predictions for the unknown spins have been made. Some remarks have been made about the odd—even nuclei. (auth)

18662 ATOMIC STRUCTURE EFFECTS IN NUCLEAR EVENTS. Freedman, M. S. (Argonne National Lab., IL). Annu. Rev. Nucl. Sci.; 24: 209-247(1974).

This review treats some effects within the atom (or molecule) that affect or are consequences of "nuclear" events within that atom (or molecule) only. All such interactions during the primary nuclear event appear to be virtual, as in internal conversion; no current evidence firmly indicates direct interaction of real nuclear radiation with the structure of the parent atom, to a measurable extent. The review is devoted to two topics, the energetics of atomic electron interactions in nuclear events and the shaking process. The former is treated under the following headings: alpha decay and fission, beta decay (binding energy change; rearrangement energy distribution; screening, overlap, and exchange effects), orbital electron capture, and internal conversion. The shaking process is subdivided as follows: beta decay (theory, experiment, outer shell shaking), electron capture, internal conversion (comparison to double conversion, adiabatic conversion at relativistic energies), and alpha decay. (2 figures, 4 tables, 181 references) (RWR)

18663 MESON—NUCLEUS SCATTERING AT MEDIUM ENERGIES. Sternheim, M. M. (Univ. of Massachusetts, Amherst); Silbar, R. R. Annu. Rev. Nucl. Sci.; 24: 249-277(1974).

This review is restricted to scattering from nuclei with $A > 4$, with particular reference to the total and elastic differential cross sections. The emphasis is on pion reactions. The basic approach is through the optical potential. After derivation of this potential and comparison of its predictions with representative data, several newer theoretical approaches are sketched. Section headings are as follows: Pion—nucleon interaction; Experimental aspects (beams, total cross sections, angular distributions, reaction cross sections); Theoretical aspects—derivation of optical potential (impulse approximation, uncorrelated nucleus approximation, coherent approximation, large-nucleus approximation, no-recoil approximation, lowest-order optical potential, pion absorption), pion—nucleus optical potentials (simplest optical potential, Kisslinger potential, Laplacian model, effective radius model), relativistic wave equation, the Glauber approximation; Comparison with experiment—inputs, elastic differential cross sections (resonance region, lower energies, small-angle scattering), total cross sections (position of resonance peak, neutron radius, dispersion relations), excitation of low-lying nuclear states, charged kaon scattering; Recent theoretical developments (other multiple scattering approaches, separable potentials, off-shell games, effects of the nuclear medium), and Outlook. (6 figures, 1 table, 128 references) (RWR)

18664 SHELL-MODEL EFFECTIVE INTERACTIONS AND THE FREE NUCLEON—NUCLEON INTERACTION. Kuo, T. T. S. (State Univ. of New York, Stony Brook). Annu. Rev. Nucl. Sci.; 24: 101-150(1974).

Shell-model effective interactions and their derivations from the free nucleon—nucleon interaction are reviewed. Only effective interactions for open-shell nuclei are considered. The outline of the review is as follows: shell-model effective interactions (empirical matrix elements of V_{eff}, deduction of V_{eff} directly from the experimental spectrum, effective interactions of simple forms, derivation of V_{eff} from the free nucleon—nucleon interaction), microscopic theories (theories of Feshbach and Bloch—Horowitz, the folded-diagram theory, the Green's function theory), reaction matrix for finite nuclei (choice of single-particle spectrum, accurate treatments of the exclusion operator, the separation method), core polarizations, and convergence and other topics of current interest (higher-order core polarizations, solvable models, summation of folded diagrams, and Padé approximants, conclusions). (30 figures, 1 table, 78 references) (RWR)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 17605, 17646, 18168, and 18169.

18665 ENERGY LOSS OF α PARTICLES IN GASEOUS C–H AND C–H–F COMPOUNDS. Lodhi, A.S.; Powers, D. (Baylor University, Waco, Texas 76703). Phys. Rev. A 10: No. 6, 2131-2140 (Dec 1974).

The stopping powers of six gaseous compounds $C_2H_2F_2$, $C_2H_4F_2$, C_3H_8, C_4H_6, C_4H_{10}, and C_3H_4 (allene) for α particles of energies 0.3 to 2.0 MeV have been measured in a differentially pumped gas–cell system with probable random errors ranging from 0.7% to 1.3%. An ambiguity in the interpretation of previous stopping–power measurements in hydrocarbon and halogen–carbon compounds has been resolved, and it is shown that all the previous data, as well as the present data involving straight–chain single–bond compounds, can be fitted by an atomic stopping power for carbon identical to the vapor–deposited solid–carbon stopping power. A rule has been obtained to predict the molecular stopping power of aliphatic saturated hydrocarbons. It is found that due consideration must be given to molecular structure when predicting molecular stopping powers from atomic stopping powers for double–bonded compounds. (auth)

18666 VACANCY CONFIGURATIONS OF ARGON PROJECTILE IONS IN SOLIDS. Knudson, A.R.; Burkhalter, P.G.; Nagel, D.J. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Rev. A 10: No. 6, 2118-2122 (Dec 1974).

The use of high–resolution x–ray measurements in determining the electronic vacancy configuration of an energetic ion inside a solid has been applied to 4.0– and 5.0–MeV Ar projectiles incident on a KCl target. The Ar $K\alpha_{1,2}$ line is found to be shifted to higher energies by 6.1 ± 0.6 and 8.1 ± 0.6 eV, respectively, at these bombarding energies. These shifts correspond to five and six vacancies in the Ar 3s–3p subshells. The Cl $K\alpha_{1,2}$ line is used as a reference line and thin–target x–ray cross–section measurements are used to show that Cl and Ar are excited in the same manner. (auth)

18667 TRANSMISSION OF MONOKINETIC ELECTRONS THROUGH THIN FILMS. Zeller, C. (Univ., Nancy); Coulon, J.; Ruste, J. Compt. Rend., Ser. B; 278: No. 24, 1043-1046(10 Jun 1974). (In French).

A relation which determines the transmission coefficient of thin films for a beam of monokinetic electrons (energies between 5 and 50 keV) was obtained from semi-empirical bases. The theory takes into account the relative importance of simple and multiple scattering phenomena. The expression of simple analytical form agrees well with experimental results. (auth)

Radiation Protection Standards

Refer also to abstracts 16524, 16837, and 16862.

18668 (WASH-1359, pp 291-309) STANDARDS FOR THE TRANSURANIC ELEMENTS. Stannard, J. N. (Univ. of Rochester, NY). Dec 1974.

In plutonium and other transuranium elements.

The official primary standards for the transuranium elements remain as they were established in 1959 except for certain additions and modifications of derived figures. It is pointed out that changes would have been made quickly and certainly if the growing storehouse of biological information had begun to indicate any serious flaws in the basic information used originally. Over the years since 1959 much new biological information has been gathered and formulated. In addition to different values for some of the metabolic parameters, we have a new and more versatile lung model, a new GI tract model, and much more about standard man. Applications of these data to future changes in standards for maximum permissible body burdens for transuranium elements in man are postulated. (CH)

Shielding Calculations and Experiments

18669 (ORNL-TM-4754) SHIELDING CALCULATIONS FOR A 200-MeV PROTON ACCELERATOR AND COMPARISONS WITH EXPERIMENTAL DATA. Alsmiller, R. G. Jr.; Santoro, R. T.; Barish, J. (Oak Ridge National Lab., Tenn. (USA)). Feb 1975. Contract W-7405-eng-26. 21p. Dep. NTIS $4.25.

Calculated results, obtained using a combination of Monte Carlo and discrete ordinates methods, are presented and compared with experimental activation and dose-equivalent data for 200-MeV protons incident on a thick water shield. The calculational geometry is only very approximately that used experimentally, but reasonable agreement between the calculated and experimental data has been obtained. Calculated results of the neutron spectra produced in various angular intervals by 200-MeV protons in thin and thick aluminum targets and the dose equivalents as a function of radius in a concrete shield when these spectra are isotropically incident at the center of the shield are also presented. (auth)

18670 NEUTRON PROTECTION. Chapter 5. Kimel, L. R.; Mashkovich, V. P. pp 197-269 of Ionizing Radiation Protection. Moscow; Atomizdat (1966). (In Russian).

This section of the handbook presents data on the following aspects of neutron shielding: neutron sources, calculations on the space–energy distribution of neutrons in various materials, dose composition of neutron radiation in shielding materials, dose buildup factors for concretes, cross sections for removal of neutrons, nomograms for calculating water shielding for neutrons from laboratory sources (by the (α,n) reaction), absorption cross sections for thermal neutrons and activation cross sections for thermal and reactor neutrons, and gamma spectra during thermal neutron capture. (tr-INIS)

18671 RADIATION PASSING THROUGH DISCONTINUITIES IN A SHIELD. Chapter 7. Kimel, L. R.; Mashkovich, V. P. pp 276-295 of Ionizing Radiation Protection. Moscow; Atomizdat (1966). (In Russian).

This section of the handbook deals with the passage of radiation through discontinuities in the shielding. A brief review is given of the most widely used methods of calculating the passage of radiation through discontinuities. Consideration is given to the passage of radiation through channels in shielding and through shielding having a distribution of hollow cavities. (tr-INIS)

18672 SHIELDING FROM α AND β RADIATION. Chapter 6. Kimel, L. R.; Mashkovich, V. P. pp 270-275 of Ionizing Radiation Protection. Moscow; Atomizdat (1966). (In Russian).

This section of the handbook deals with shielding from alpha and beta radiation. Data are presented on the ranges of alpha and beta particles in air, aluminum, and biological tissue as a function of particle energy referred to the mass and linear attenuation coefficients for Al. A technique is described for calculating the shielding from bremsstrahlung radiation. (tr-INIS)

PHYSICS (THEORETICAL)

General

Refer also to abstracts 18186, 19131, 19132, and 19136.

18673 (AED-CONF-74-044-005) SEDAP: PROGRAM SYSTEM FOR PROCESSING OF EXPERIMENTAL DATA. Dorr, B. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Reaktorentwicklung). 25 Mar 1974. 7p. (In German). INIS.

From exhibition and experts' meeting "nuclear technology"; Frankfurt am Main, F.R. Germany (18 Mar 1974).

1 fig.

SEDAP is a program system for the processing of measured data which serves as a coupling member between data recording and processing. It offers the possibility of evaluating data with the most simple possible operation as well as presenting it graphically and in tables. (GE)

18674 (CNRS-CPT-73-P-577) SCATTERING THEORY WITH SINGULAR POTENTIALS. II. The n-Body Problem and Hard Cores. Ferrero, P.; de Pazzis, O.; Robinson, D. W. (Centre National de la Recherche Scientifique, 13 – Marseille (France). Centre de Physique Theorique). Oct 1973. 27p. Dep. NTIS (U. S. Sales Only) $4.50.

Results of absolute continuity and asymptotic completeness are proved for n-particles interacting with positive, spherically symmetric, decreasing potentials which are arbitrarily singular at the origin. Hard cores are also allowed. The scattering matrix for n hard spheres was shown to be unitary. Results for weakly attractive potentials are also given. These results are valid in all but two-dimensional space. (auth)

18675 (INIS-mf-1277) TRANSCRIPTION BETWEEN SPINORIAL AND TENSORIAL EQUATIONS OF THE PHYSICS. Figueroa, E. J. M. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1973. 107p. (In Spanish). INIS.

A systematic procedure was developed for transcribing any linear spinor equation into equations with a tensor character equivalent to the original equations. The method used is the following. To each spinor is associated a quadratic matrix of the same order as the matrices appearing in the spinor equation; this can be considered a matrix equation. A base of the quadratic matrix space is selected which has tensor properties in Minkowski space. The matrices appearing in the equation are resolved for transcribing in terms of this base. By the use of multiplication tables between the elements of such a base, equations are derived with a tensor character. In particular in the case of the Dirac equation the $\gamma\mu$ matrices generate a base of the 16-dimensional space with 4 × 4 quadratic matrices which has tensor properties in the Minkowski space. It is then possible to associate with a Dirac spinor a conjunct of variables which have scalar, vector, tensor, pseudovector, and pseudoscalar behavior in space-time and equations are derived for them. The tensor transcription can be written then for the Dirac equation in the case of a free particle and a particle in interaction with an electromagnetic field. The charge conjugation is interpreted in terms of the tensor quantities. The method is applied to these tensor quantities, transcribing equations with a tensor character (Maxwell equations) in equivalent matrix equations. (tr-auth)

18676 (INP–809/PL) GENERALIZED OSCILLATOR IN THE FRAMEWORK OF MATRIX MECHANICS. Kepuscik, E. (Institute of Nuclear Physics, Krakow (Poland)). Sep 1972. 10p. INIS.

Generalizing the kinematical relation between the momentum and velocity, new solutions of the oscillator dynamics are described. (auth)

18677 (JINR-E2-8285) ONE-BOSON-EXCHANGE RELATIVISTIC AMPLITUDE AS QUANTUM MECHANICAL POTENTIALS IN LOBACHEVSKY SPACE. Skachkov, N. B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

It is shown that the matrix elements of the relativistic scattering amplitude which correspond to one-boson exchange can be represented in the form of the direct geometrical generalization of quantum mechanical potentials, obtained by a replacement of Euclidean quantities by their analogs in Lobachevsky space. (auth)

18678 (JINR-P2-8287) LOCAL FORM OF THE CHEW–LOW EQUATION SOLUTION. Gerdt, V. P.; Meshcheryakov, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The neighborhood of the degenerated rest point of the Chew–Low equations is investigated. The solution is constructed that approaches this point. The obtained solution depends on three arbitrary functions. (auth)

18679 (SAND-74-0430) ACTIVITIES REPORT: APPLIED MATHEMATICS DEPARTMENT: 5120. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 51p. Dep. NTIS $5.75.

Research is summarized on mathematical physics and computational and discrete mathematics. (JFP)

18680 (ULPS-5) INTRODUCTION TO THE EPISTEMOLOGY OF QUANTUM MECHANICS. Lestienne, R. (Strasbourg-1 Univ., 67 (France)). 1973. 26p. (In French). (CONF-720134-2). Dep. NTIS (US Sales Only) $4.50.

From seminar on the foundation of sciences; Strasbourg, France (13 Jan 1972).

A summary is given of the different concepts of the physical world (and one's relation with them) which are used as the basis of quantum mechanics. The history behind the abandoning of classical mechanics and the extension of wave-corpuscule duality to matter is presented. The complementarity principle is introduced together with the quantum mechanics syllabus. The axioms of quantum mechanics are briefly presented. Several consequences of great epistemological importance are reviewed (indistinguishability of particles, uncertainty relations). Some particular problems are considered: the handling of time and space, the inseparability of quantum systems, and objectivity and measurements in quantum mechanics. (auth)

18681 (ULPS-6) NONSEPARABILITY. D'Espagnat, B. (Strasbourg-1 Univ., 67 (France)). 1973. 11p. (In French). (CONF-720134-1). Dep. NTIS (US Sales Only) $4.00.

From seminar on the foundation of sciences; Strasbourg, France (13 Jan 1972).

It is shown how the hidden variable concept was introduced into quantum physics. The Bell inequalities are considered. These inequalities show that nonseparability appears in any hidden variable theory where an attempt is made not to modify the predictions observable in quantum mechanics. (auth)

18682 QUANTUM CORRECTIONS TO THE STRESS TENSOR IN PERTURBATION THEORY. Yamada, K. (Tokyo Inst. of Tech.). Phys. Rev., D; 10: No. 2, 599-613(15 Jul 1974).

Quantum corrections to the stress tensor are studied within the framework of the perturbation theory. Both the Feynman cutoff method and the Bogoliubov-Parasiuk-Hepp (BPH) cutoff method are used in the scalar theory with ϕ^4 coupling. In the case of the Feynman cutoff method, the quantum corrections to the stress tensor depend on the ratio of the regulator masses. To get the definite corrections, an additional renormalization condition is essential. To O (λ^2), the finite stress tensor is $\theta_{\mu\nu} = T_{\mu\nu} + {}^1\!/_6[1 + \lambda/(48\pi^2)]\ (\partial_\mu \partial_\nu - \delta_{\mu\nu}\partial^2)\phi^2$, where $T_{\mu\nu}$ is the canonical stress tensor and λ is the coupling constant. The BPH cutoff method, on the other hand, gives a fairly general basis to get the finite corrections. Explicit formulas are given to $O(\lambda^2)$. Finally the relation between the on-mass-shell renormalization and the off-mass-shell renormalization of the stress tensor is investigated in detail. (auth)

18683 APPROXIMATE LORENTZ-INVARIANCE AND QUASI-RELATIVISTIC HAMILTONIANS. II. Quantum Mechanical of Spinless Particles. Gaida, R. P. (Lvov State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 9, 1526-1532(Sep 1974). (In Russian).

The condition for the approximate Lorentz-invariance of the Hamiltonian quasi-relativistic operator of the interacting particle system and the general form of this operator are found. The problem of the approximate Lorentz-invariance of the corresponding wave equation is analyzed. (auth)

18684 OSNOVY TEORII GRUPP. (Principles of Group Theory). Kargapolov, M. I.; Merzlyakov, Yu. I. Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Fiziko-Matematicheskoi Literatury (1972). 240p.

The principles of group theory, one of the important divisions of contemporary algebra, are presented. In addition to traditional material concerning the inherent principles of group theory, some recent achievements in this area are discussed. Special attention is given to examples and exercises explaining the basic concepts and results. (tr-auth)

18685 CLASSIFICATION ACCORDING TO INTERNAL SYMMETRIES IN THE QUANTUM-MECHANICAL MANY-BODY-PROBLEM. P. 2. n-Particle-Systems with Harmonic Interac-

tion. Wunner, G. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Inst. fuer Theoretische Physik). Z. Phys.; 269: No. 4, 411-420(Sep 1974). (In German).
5 tabs.; 8 refs.

For systems of n identical particles with harmonic two-body interaction a method is derived which allows for any n the construction of a complete orthonormal set of functions that are translationally invariant and are classified according to energy, permutational symmetry, SU(3), angular momentum, and parity. Moshinsky's method for the determination of translationally invariant states with definite permutational symmetry for harmonic two-body interaction is briefly reviewed and it extended to additional SU(3)-classification. His method, however, is seen to be restricted to the cases n = 3, n = 4. (auth)

18686 FIFTIETH ANNIVERSARY OF QUANTUM MECHANICS. Lestienne, R.; Paty, M. (CNRS, Paris). Recherche (Paris); 5: No. 47, 644-653(Jul 1974). (In French).

The most important features of the development of the theory of quantum mechanics since its appearance are outlined. The main definitions were established between 1924 and 1930. The interpretation of the Copenhagen school is still much debated and recent attempts have been made to reconcile it with locality and causality. (auth)

18687 NEW PHYSICS AND QUANTA. Second Edition. de Broglie, L. Paris; Flammarion (1974). 239p. (In French).

The ideas of Louis de Broglie about wave mechanics are introduced to the general public. (auth)

18688 BASIS FOR A NEW RELATIVITY. Ryff, L. C. B. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 22: No. 5, 109-144(1974).

A "principle of kinematical relativity" is introduced, and a group of transformations, valid for any kind of motion, is derived. The Poincaré group is obtained as a subgroup. The special conformal group is also obtained, but it is seen that it is not related to hyperbolic motion. Some assumptions of general relativity are discussed; they are seen to be not justifiable. The "clock hypothesis" is seen to be valid only in the case of uniform rectilinear motion. A new explanation to Newton's bucket experiment is disclosed. The conjecture is raised that the physical laws can be expressed by equations that are covariant under this new group of transformations. Maxwell – Lorentz equations are seen to satisfy such requirement. However no systematic attempt is made in this direction, but some features of the problem are outlined; as a consequence it follows that kinematics and dynamics seem to be closely related. (auth)

Quantum Field Theories

Refer also to abstracts 18136, 18248, 18249, and 18341.

18689 (COO-2271-33) INTERACTION OF A DENSE FERMION MEDIUM WITH A SCALAR MESON FIELD. Lee, T. D.; Margulies, M. (Columbia Univ., New York (USA)). 1974. 65p. Dep. NTIS $6.25.

The interaction between a dense Fermion medium and a scalar meson field is studied. It is shown that in the quasi-classical approximation, independent of the details of the theory, at low fermion density the lowest energy state is normal (i.e., effective fermion mass $m_{eff} \cong$ free mass), but at high density the state is abnormal (i.e., $m_{eff} \cong 0$). The nature of the transition is analyzed at zero and low temperatures. The main concern is to examine the problem of quantum fluctuation. Both the one- and two-loop diagrams are calculated. By developing a variational formalism involving only two-line irreducible diagrams, a suitable high density expansion for the energy is derived. The quasi-classical solution emerges as the lowest order term in this expansion. Therefore, when the expansion is valid, the overall description of the transition given by the quasi-classical solution remains correct with the inclusion of quantum corrections. (auth)

18690 (JINR-E2-8241) CONFORMAL INVARIANT EUCLIDEAN TWO-POINT FUNCTION FOR TENSOR FIELDS. Zaikov, R. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

The conformal invariant Euclidean two-point function for "fundamental" tensor fields is given as a decomposition in terms of the projection operators on the subspaces with definite spin. The scale dimensions of these fields may be arbitrary. The clue to the solution of the problem is the use of the formalism of function on unit sphere (instead of the tensor formalism or the formalism of homogeneous polynomials) in the description of the irreducible representations of the group SO(4). For such functions there exists a scalar product, which replaces the summing over the repeated indices. (auth)

18691 (JINR-E2-8308) RENORMALIZATION OF SUPERSYMMETRIC GAUGE THEORIES. I. Quantum Electrodynamics. Slavnov, A. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. Dep. NTIS (US Sales Only) $4.25.

An invariant renormalization procedure for supersymmetric quantum electrodynamics is constructed. It is shown that all ultraviolet divergencies may be removed by the common wave function and mass renormalization of matter fields and the wave function renormalization of the gauge multiplet. (auth)

18692 (JINR–P2-8148) PERTURBATION APPROACH TO THE "DRESSING" OF THE FIELD THEORY AND DIVERGENCES. Vishinesku, M.; Shirokov, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The perturbation approach to the "dressing" of the field theory proposed by L. D. Faddeev is considered. It is shown that in the case of Yukawa interaction $\lambda\bar{\psi}\gamma_5\psi\phi$ the "dressing" procedure leads to an interaction Hamiltonian with additional divergences which are not present in the S-matrix and cannot be removed by the usual renormalization rules. The possibility or removing these divergences by means of some modification of the Faddeev procedure is discussed. (auth)

18693 (JINR-P2-8212) CONFORMAL-INVARIANT EXPANSION OF THE THREE- AND FOUR-POINT FUNCTIONS. Zaikov, R. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A conformal-invariant expansion of the three-point function of two scalar and one tensor field is obtained. The formalism of the homogeneous polynomials, replacing the usual tensor indices, is essentially used for the purpose. The conformal-invariant three-point function is determined up to one normalization constant. Using the expansion of the three-point function a corresponding expansion for the four-point function is obtained also. (auth)

18694 (JINR-P2-8237) SUPERGAUGE SYMMETRY AND SCALE DIMENSION OF FIELDS. Dao Vong Dyc. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

On the basis of supergauge symmetry and scale invariance the relations for two- and three-point correlation functions and the expressions for the scale dimension of fields in terms of the coupling constants are obtained. (auth)

18695 (JINR-P2-8362) COHERENT STATES. II. Polubarinov, I. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The consideration of the coherent state method applied to the relativistic quantum field theory is continued. A theorem is shown that any operator is uniquely determined by its diagonal matrix elements in the coherent states. On this basis a comparison of the present method with that of the Schwinger sources was made. (auth)

18696 (JINR-P2-8371) COORDINATE OPERATOR IN QUANTUM FIELD THEORY. Polubarinov, I. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 29p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A coordinate operator is defined as a generator of multiplication of field operator, say, $\phi(x)$ on x_μ. A variational principle is applied to derive it (like other nonconserved operators). It is shown that such coordinate operators are in accordance with a causality requirement. (auth)

18697 (ORO-3992-127) PROBLEMS OF FUNCTIONAL DETERMINANT AND FICTITIOUS LAGRANGIAN IN GAUGE THEORIES. Hsu, J. P.; Sudarshan, E. C. G. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 12p. (CPT-175). Dep. NTIS $4.00.

Using the method of Lagrange multiplier fields the fictitious Lagrangian of gauge-fixed gauge theories can be constructed. One obtains different but equivalent forms depending on the extent to which constraint equations are used. These constructions yield fictitious Lagrangians which restore unitarity and gauge invariance. The usual method of constructing fictitious Lagrangians using the change of gauge conditions under gauge transformations does not always lead to the same fictitious Lagrangian constructed by the above method. They are, however, related by an interchange of fictitious fields and lead to the same amplitudes. A scale transformation of the fictitious fields is also discussed, which changes the explicit form of the fictitious Lagrangian but not its amplitudes. In the course of this study certain technical problems are displayed in the definition of the functional determinants related to a fictitious Lagrangian. (auth)

18698 (ORO-3992-193) RENORMALIZABLE MASSIVE VECTOR–BOSON THEORIES WITH DISTORTED LOCAL GAUGE SYMMETRY. Hsu, J. P. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 6p. (CPT-237). Dep. NTIS $4.00.

A formal foundation is given for general renormalizable massive vector–boson theories with distorted local gauge symmetry which includes two different symmetries, i.e., spontaneously broken symmetry and intrinsically broken symmetry, as special cases. The Ward–Takahashi identities are derived. Unitarity and gauge independence of the physical S-matrix are formally proved. (auth)

18699 (ORO-3992-195) SOLUTIONS OF THE BETHE–SALPETER LADDER EQUATIONS IN THE WEAK BINDING LIMIT. Narayanaswamy, P. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 14p. (CPT-239). Dep. NTIS $4.00.

The scalar bound state problem described by the Bethe–Salpeter equation in the ladder approximation is studied in the limit of vanishingly small binding energy. The eigenvalues for the coupling constant are uniquely determined and the "abnormal" solutions do not occur. The bound state wave functions which are odd in relative time do not exhibit the branch point behavior characteristic of the two particle continuum. (auth)

18700 (ORO-3992-197) RENORMALIZABLE MASSIVE YANG–MILLS THEORY WITH INTRINSIC SYMMETRY BREAKDOWN. Hsu, J. P.; Underwood, J. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 11p. (CPT-241). Dep. NTIS $4.00.

The method of the Lagrange multiplier field is used to construct, within the framework of indefinite-metric field theory, a model of a massive Yang–Mills field, the mass of which derives from an intrinsic symmetry breakdown, rather than a spontaneous symmetry breakdown. The rules for the Feynman diagrams are given. The dynamical structure of the interacting fields is intrinsically related to a local non-Abelian gauge symmetry which renders the theory renormalizable by standard power counting. The part of the amplitude due to the interaction of unphysical particles in the intermediate states, which violates unitarity and gauge symmetry, is isolated and removed, leaving the unitary physical S-matrix. The unitarity of the resulting theory, together with its independence with respect to the parameter ξ, is demonstrated in calculations at the one-loop and the two-loop levels. (auth)

18701 DERIVATION OF CROSSING RELATIONS AND ITS PHYSICAL MEANING Mignani, R. (Univ., Rome); Recami, E. Nuovo Cim.; 24A: No. 4, 438-448(21 Dec 1974).

The "crossing relations" of the usual elementary-particle (high energy) physics are derived on the basis of Lorentz covariance, generalized also to superluminal inertial frames. In this framework the "analiticity" postulate is unnecessary, and is better substituted by the G-covariance requirement (i.e. covariance under the new group G of generalized Lorentz transformations, both subluminal and superluminal). Moreover, new "crossing type" relations are predicted on the basis of mere "extended relativity." They may well serve as a test for relativistic covariance of "force fields" like strong interactions and, particularly, weak interactions, and possible new "interaction fields" (which a priori are not relativistically covariant). (auth)

18702 GAUGE FIELDS AS BOUND STATES OF SUBCANONICAL FERMION FIELDS. Saller, H. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Nuovo Cim.; 24A: No. 4, 391-420(21 Dec 1974).

Renormalizable field theories of locally coupled fermion fields can be formulated with subcanonical fields. The canonical formulation of theories with subcanonical fields is given. The behavior of gauge fields which arise as bound states in these theories is studied, and a way is proposed to incorporate vacuum asymmetries (and as a consequence more degrees of freedom for low energies) like violation of scale invariance and isospin. (auth)

18703 TACHYONS AND BRADYONS. Aust. Phys.; 11: No. 10, 197-199(Oct 1974).

The production of tachyons from cosmic rays is considered and a discussion of the evidence for their existence is given. Other questions which are considered include: 1) how does a tachyon interact, 2) could tachyons exist unnoticed, 3) would physics be changed much by tachyons. (RL)

18704 INFRARED BEHAVIOR OF YANG–MILLS THEORIES. Brandt, R.A. (Department of Physics, New York University, New York, New York 10003); Ng, W.C.; Wing-Chiu, N. Phys. Rev. Lett. 33: No. 27, 1640-1643 (30 Dec 1974).

The ultraviolet freedom of non–Abelian gauge theories is used to suggest the presence of a new symmetry of the exact theory which is not present in finite orders of perturbation theory. The infrared behavior of these theories is determined as a consequence of this symmetry. (auth)

18705 THE CONSTRUCTION OF SOLUTION OF NONLINEAR RELATIVISTIC WAVE EQUATION IN $\lambda{:}\Phi^4_4$: THEORY. Rączka, R. (Institute of Nuclear Research, Warsaw, Hoża 69, Poland). J. Math. Phys. (N.Y.) 16: No. 2, 173-176 (Feb 1975).

The nonlinear equation $(\Box + m^2)\,\Phi(x) = \lambda{:}\Phi^3$: for the quantum scalar field with special form of ordering of the interaction term is considered. The unique solution $\Phi(x)$ of this equation is constructed. It satisfies the relativistic covariance, asymptotic, irreducibility and the relativistic primitive causality conditions in the sense of sesquilinear form. The spectral condition is also satisfied. (auth)

18706 AN EIKONAL PERTURBATION THEORY HAVING APPLICATIONS IN HADRON DYNAMICS, I: GENESIS. Orzalesi, C.A. (International Centre for Theoretical Physics, Trieste, Italy). Ann. Phys. (N.Y.) 88: No. 1, 88-156 (Nov 1974).

We develop a Lagrangian field–theoretic laboratory where one can rigorously investigate ideas and problems in high–energy hadronic interactions. In this paper (the first of a series) the general field–theoretic framework is outlined in the oversimplified model of a scalar–scalar Yukawa interaction. Functional methods are used to cast all Green's functions in an "operator eikonal" form. The eikonal approximations (EA's) in Lagrangian relativistic quantum mechanics are reviewed and discussed. We then derive an exact eikonal equation in quantum field theory. The perturbation theoretic solution of this equation leads to a new kind of eikonal perturbation theory (EPT) which generalizes simultaneously the EA's as well as the ordinary perturbation theory (OPT). Some salient features of Green's functions in the EPT are as follows: (i) the lower–order EPT amplitudes correspond to a kind of semiclassical approximation; (ii) the lowest–order four–point amplitudes contain the high–energy part of the full radiatively corrected crossed ladder series, without vacuum polarization effects; (iii) for spin one gluons, the latter amplitude develops diffractive behavior in the direct channel and, for spin one and spin–zero gluons, Regge behavior in the crossed channel; (iv) for vanishing gluon mass, this amplitude develops poles, in the direct channel, corresponding to a positronium–like bound–state spectrum. Properties (i)–(iv) are generalized to EPT from EA's and are absent in OPT. Unlike in the case of EA's we also have that (v) the EPT is a quantum field theory, which properly includes self–interaction effects; (vi) the EPT is an iterative perturbation theoretic scheme, which shares with OPT the properties of renormalizability. (auth)

18707 MASSIVE GAUGE FIELD IN SOURCE THEORY. II. Finkelstein, R.J.; Smit, J. (Department of Physics, University of California, Los Angeles, California 90024). Ann. Phys. (N.Y.) 88: No. 1, 157-192 (Nov 1974).

In an earlier source theory investigation it was shown that the vacuum polarization of a massive gauge field is finite, provided that the conservation of current is imposed everywhere, including the interior of the sources. It is shown in the present paper that radiative corrections to a vertex function (two–particle production by an external source) are also finite if the same requirement about current conservation is imposed. In other words one–loop corrections turn out to be finite in both calculations. The cancellations leading to convergence may be understood in terms of Ward identities. The three form factors that appear are not only shown to be finite but are also explicitly found. (auth)

18708 ROLE OF LOCALITY IN PERTURBATION THEORY. Epstein, H.; Glaser, V. (European Organization for Nuclear Research, Geneva). Ann. Inst. Henri Poincare, Sect. A; 19: No. 3, 211-295(1973).

It is shown how an inductive construction of the renormalized perturbation series of quantum field theory automatically yields, at each order, finite terms satisfying the requirements of locality. This method whose result is equivalent to the Bogoliubov-Parasiuk-Hepp prescriptions, also establishes the usual classification between renormalizable and nonrenormalizable theories. (auth)

18709 TACHYONS: PARTICLES MOVING WITH VELOCITIES GREATER THAN THE SPEED OF LIGHT. Barashenkov, V. S. (Joint Inst. for Nuclear Research, Dubna, USSR). Usp. Fiz. Nauk; 114: No. 1, 133-149(Sep 1974). (In Russian).

Einstein's theory states that a particle moving with a velocity $v < c$ (velocity of light) cannot be converted into a tachyon by a continuous increase in velocity, and conversely, tachyons, if they exist in nature cannot go over into ordinary particles by a gradual decrease in velocity. In other words, tachyons and ordinary particles are essentially different types of particles. Tachyons have no need to surmount the light barrier. They can be generated and absorbed while always having a velocity $v > c$. This review covers some of the properties of tachyons. For example, on losing energy, tachyons are accelerated. The principle of casuality with respect to tachyons is examined, and it is concluded that tachyons can have many unusual properties which would complicate the experimental search for their existence. Data for the existence of tachyons are reviewed in the fields of astrophysical phenomena, in experiments on particle stability, in accelerator experiments and in experiments with the Cherenkov radiation of tachyons. After reviewing the evidence, it is concluded that the problem of the existence of tachyons is still an open one. (SJR)

Gravitation and General Relativity

18710 (EFI-38(73)) LINEARIZED GRAVITATION THEORY WITH EXTENDED TRANSFORMATION GROUP. Gol'dman, I. I. (Erevanskij Fizicheskij Inst. (USSR)). 1973. 11p. (In Russian). INIS.

The proposed theory of gravitation differs from Einstein's theory in the selection of field values and Lagrangian density, and is in a symbolic sense a linearization (as it were an extraction of the square root) of the general theory of relativity (in the same sense as the theory of Dirac linearizes the Klein–Gordon equations). A local unimodular group SL_2 (isomorphous to the eigen group of Lorentz) appears in the theory. A difference from the general theory of relativity makes itself manifest only in the presence of matter (of the spinor field, for example). In view of the fact that the Lagrangian density is linear in the first derivatives and is semilinear in fields, the theory takes quantization for granted. (tr-SJR)

18711 SPACETIME SYMMETRIES AND THE COMPLEXION OF THE ELECTROMAGNETIC FIELD. Ray, J.R.; Thompson, E.L. (Department of Physics and Astronomy, Clemson University, Clemson, South Carolina 29631). J. Math. Phys. (N.Y.) 16: No. 2, 345-346 (Feb 1975).

Considering spacetimes admitting groups of motions, we derive the symmetry imposed on the electromagnetic field for solutions to the Einstein–Maxwell equations. It is found that the scalar products between the gradient of the complexion and the Killing vectors must be constants and that these constants enter into the symmetry condition on the electromagnetic field. We therefore obtain a geometrical interpretation of the complexion in spacetimes having symmetries. (auth)

18712 SOME PROPERTIES OF ASYMPTOTICALLY FLAT, STATIC, EINSTEIN–MAXWELL SPACE–TIMES. Hallidy, W. (California State College, California, Pennsylvania 15419). J. Math. Phys. (N.Y.) 16: No. 2, 322-325 (Feb 1975).

We show that the generators of the Weyl tensor for asymptotically flat, static, Einstein–Maxwell space–times are electric type to asymptotic order r^{-7} and that for space–times which are stable under static perturbations the generators of the electromagnetic field tensor are electric type to order r^{-5}. We also argue that the Weyl tensor, the Ricci tensor, and the electromagnetic field tensor may fail to be electric type in general for asymptotically flat, static, Einstein–Maxwell space–times but that the generators of the Weyl tensor and the electromagnetic field tensor may still be electric type in general. The variable r is an affine parameter along null geodesics. (auth)

18713 THE SAGNAC EFFECT IN GENERAL RELATIVITY. Ashtekar, A.; Magnon, A. (Enrico Fermi Institute, University of Chicago, Chicago, Illinois). J. Math. Phys. (N.Y.) 16: No. 2, 341-344 (Feb 1975).

The Sagnac effect is a phase shift observed between two beams of light traversing in opposite directions the same closed path around a rotating object. A description of this experiment is obtained within the context of general relativity. In this context the effect provides an operational definition of rotation. An expression for the magnitude of the phase shift is derived under fairly general conditions. The general definition of rotation provided by this experiment is shown to reduce, in certain particular cases, to the usual definitions available. It is observed that the Sagnac effect represents a gravitational analog of the Aharanov–Bohm effect in electrodynamics. (auth)

18714 A CORRECTION TO THE SEN AND DUNN GRAVITATIONAL FIELD EQUATIONS. Jeavons, J.S. (Department of Mathematics, Caulfield Institute of Technology, Caulfield East, Victoria, 3145, Australia); McIntosh, C.B.G.; Sen, D.K. J. Math. Phys. (N.Y.) 16: No. 2, 320-321 (Feb 1975).

It is shown that the gravitational field equations proposed by Sen and Dunn do not follow from their variational principle and that in the vacuum case the correct field equations are related to Einstein's field equations by a conformal mapping. (auth)

18715 CLOSED GRAVITATIONAL–WAVE UNIVERSES: ANALYTIC SOLUTIONS WITH TWO–PARAMETER SYMMETRY. Gowdy, R.H. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). J. Math. Phys. (N.Y.) 16: No. 2, 224-226 (Feb 1975).

Einstein's vacuum field equations are solved for spacetimes with two–parameter spacelike symmetry, a space–reflection symmetry, and space sections homeomorphic to either $S^1 \times S^2$ or S^3. All integrals are evaluated, and the spacetime metrics are presented in analytic form. (auth)

18716 ON THE EQUIVALENCE OF THE EINSTEIN–MAYER AND EINSTEIN–CARTAN THEORIES FOR DESCRIBING A SPINNING MEDIUM. Mahanta, M.N. (Department of Mathematics, Indian Institute of Technology, Delhi, New Delhi–110029, India); Rao, A.S. J. Math. Phys. (N.Y.) 16: No. 2, 381-383 (Feb 1975).

It is shown that the five–dimensional formalism of the Einstein–Mayer theory of 1932 can be given a new interpretation and used to describe a continuous medium with intrinsic angular momentum. The equations of motion of a spinning particle are derived from the generalized field equations and are seen to be essentially the same as the Mathisson–Papapetrou equations. Finally the correspondence of the new approach with the theories based on Cartan's torsion tensor [illegible] is established. (auth)

18717 ROLE OF SURFACE INTEGRALS IN THE HAMILTONIAN FORMULATION OF GENERAL RELATIVITY. Regge, T. (Institute for Advanced Study, Princeton, New Jersey 08540); Teitelboim, C. Ann. Phys. (N.Y.) 88: No. 1, 286-318 (Nov 1974).

It is shown that if the phase space of general relativity is defined so as to contain the trajectories representing solutions of the equations of motion, then, for asymptotically flat spaces, the Hamiltonian does not vanish but its value is given rather by a nonzero surface integral. If the deformations of the surface on which the state is defined are restricted so that the surface moves asymptotically parallel to itself in the time direction, then the surface integral gives directly the energy of the system, prior to fixing the coordinates or solving the constraints. Under more general conditions (when asymptotic Poincaré transformations are allowed) the surface integrals giving the total momentum and angular momentum also contribute to the Hamiltonian. These quantities are also identified without reference to a particular fixation of the coordinates. When coordinate conditions are imposed, the associated reduced Hamiltonian is unambiguously obtained by introducing the solutions of the constraints into the surface integral giving the numerical value of the unreduced Hamiltonian. In the present treatment there are, therefore, no divergences that cease to be divergences after coordinate conditions are imposed. The procedure of reduction of the Hamiltonian is explicitly carried out for two cases: (a) Maximal slicing, (b) ADM coordinate conditions. A Hamiltonian formalism which is manifestly covariant under Poincaré transformations at infinity is presented. In such a formalism the ten independent variables describing the asymptotic location of the surface are introduced, together with corresponding conjugate momenta, as new canonical variables in the same footing with the g_{ij}, π^{ij}. In this context one may fix the coordinates in the "interior" but still leave open the possibility of making asymptotic Poincaré transformations. In that case all ten generators of the Poincaré group are obtained by inserting the solution of the constraints into corresponding surface integrals. (auth)

18718 REGULARITIES IN THE CHANGE OF ANGULAR AND MAGNETIC MOMENTA OF BODIES IN THE GENERAL THEORY OF RELATIVITY. Ryabushko, A. P. (Belorussian Inst. of Mechanization of Agriculture, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 5, 57-67(1974). (In Russian).

In the post-Newton approximation an integration is carried out on equations of "rotational" motion which were earlier obtained in the case where bodies of comparable masses possess electrical charges, and eigenvalues of the angular and magnetic momenta. Formulas are found that determine the regularities in the change of the total momentum S_a which in the Newton approximation for any body a of a system has the form $S_a \equiv m_a\vec{\sigma}_a + 2c\,\vec{\mu}a$, where $m_a\vec{\sigma}_a$ is the angular mechanical momentum of the body a; c is the velocity of light; $\vec{\mu}_a$ is the specific magnetic momentum from the charge. In the Newton approximation S_a = const, which points to a mutual relation of the eigen momentum and magnetic field of any body a. In this study the possible consequences of this mutual relation are discussed in detail for macroscopic bodies, planets, stars, galaxies and evolutions of their magnetic fields and eigen rotations. In the post-Newton approximation $\bar{S}_a$ is not constant. The vector $\bar{S}_a$ precesses around a known constant vector having a definite angular velocity, which is small for ordinary astronomical bodies, but can be significant for systems of the type pulsar–pulsar and pulsar–satellite. Moreover the angle between $\bar{S}_a$ and the Newtonian plane of motion should vary in a secular fashion. Finally it is shown that the angular velocity of a body a, measured according to the clock of a distant stationary observer moving in the field of the remaining bodies of the system, should vary. Estimates are given for these relativistic effects. 27 refs. (tr-SJR).

18719 THREE-DIMENSIONAL, LORENTZ-COVARIANT EQUATIONS OF THE EINSTEIN THEORY OF GRAVITATION AND THEIR CHRONOMETRICALLY AND KINEMETRICALLY COVARIANT CONCEPTS. Syaglo, I. S.; Ivanitskaya, O. S. (Belorussian State Univ., Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 5, 68-74(1974). (In Russian).

Equations of Einstein's gravitational theory with respect to tetrad gravitational potentials are written in a form which is covariant with respect to the local Lorentz subgroup of spacial revolutions. It is shown that the theories of chronometric and kinemetric invariants are coordinate concepts of partial cases of such a form corresponding under reference conditions to tetrad potentials of the form $h_0^{(i)} = 0$ and $h^0_{(i)} = 0$, and also with a certain simplification of nomenclature, not causing complications within the framework of a fixed reference system. 13 refs. (tr-SJR).

18720 ANALYSIS OF THE ITERATION PROCEDURE OF GUPTA FOR A GRAVITATIONAL FIELD HAVING MATERIAL SOURCES. Sokol'skii, A. A.; Minkevich, A. V. (Belorussian State Univ., Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 5, 85-91(1974). (In Russian).

The iteration procedure of Gupta is used to construct the first, nonlinear approximation of the Lorentz-covariant theory of gravitation in the presence of material sources. It is shown that in spite of the arbitrariness in selecting the initial Lagrangian of the linearized gravitational field and the indefiniteness in determining the energy-momentum tensor the iteration procedure unavoidably leads to a theory of gravitation formally equivalent to the general theory of relativity. 14 refs. (tr-SJR)

18721 PROPERTIES OF THE ORBIT OF A TEST BODY IN THE GRAVITATIONAL FIELD OF A ROTATIONAL ELLIPSOID. Mityanok, V. V. (Inst. of Physics, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk; No. 5, 92-96(1974). (In Russian).

An explanation is given for the origin of various terms in the series decomposition for the displacement of the pericenter of the orbit of a test body according to the degrees of smallness of the eccentricity of the gravitational mass which has the form of an ellipsoid of revolution. It is shown that not only the Schwartzchild part of the correction but also a term of the form $m(\sigma^2 b^2/p^3)$ is caused by the requirement of the local correctness of the special theory of relativity (partially). 5 refs. (tr-SJR).

18722 AXIALLY SYMMETRIC FIELDS IN GENERAL RELATIVITY. Som, M. M.; da F. Teixeria, A. F.; Wolk, I. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 22: No. 8, 181-190(1974).

It is demonstrated that Einstein equations corresponding to stationary axially symmetric vacuum fields allow a special class of solutions admitting a simple interpretation—an observer describes the static Curzon field in the canonical space using a reference system which rotates with constant angular speed. The structure of the solutions remains similar if the interaction of massless scalar fields is considered. (auth)

18723 POSSIBILITY OF MEASURING THE DEPENDENCE OF THE GRAVITATIONAL CONSTANT ON TIME. Braginskii, V. B.; Ginzburg, V. L. (Moscow State Univ.). Dokl. Akad. Nauk SSSR; 216: No. 2, 300-302(11 Mar 1974). (In Russian).

A method is proposed and discussed for the measurement of $\dot{G}/G$ on the earth with a precision of at least 10^{-11} y^{-1}. (JSR)

18724 THEORY OF THE MAXWELL–EINSTEIN EQUATIONS. Bitsadze, A. V.; Pashkovskii, V. I. (Inst. of Mathematics, Moscow). Dokl. Akad. Nauk SSSR; 216: No. 2, 249-250(11 Mar 1974). (In Russian).

Two classes of solution in quadratic form are given for the Maxwell-Einstein equations. (JSR)

18725 GRAVITATIONAL FIELD OF TWO-DIMENSIONAL ELECTROMAGNETIC WAVES. Ketsaris, A. A. (Moscow Energy Inst.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 5, 112-113(1974). (In Russian).

The equation of the gravitational field is solved in a five-dimensional metric system. (JSR)

REACTOR TECHNOLOGY AND REGULATION

18726 (CONF-701074-P1) PROCEEDINGS OF THE SCIENTIFIC-TECHNICAL CONFERENCE "ATOMIC POWER, FUEL CYCLES, RADIATION STUDY OF MATERIALS", UL'YANOVSK, 5–10 OCTOBER 1970, VOL. 1. 1971. Translation of Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970. (TT-73-53042/01) 726p. Dep. NTIS $13.60.

Separate title listings or abstracts are included for each of the 42 papers presented on the development of the nuclear industry in the USSR, Bulgaria, Hungary, Poland, German Democratic Republic, and Czechoslovakia. (DCC)

For abstracts of individual papers see: 18727–18731, 18734, 18743–18747, 18752–18756, 18763–18765, 18770–18775, 18790, 18791, 19032–19038, 19059, 19082, 19084, 19097–19099, 19108, and 19109.

18727 (CONF-701074-P1, pp 1-27) NUCLEAR ENERGY OF THE SOVIET UNION. Petrosyantz, A. M. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

18728 (CONF-701074-P1, pp 28-31) DEVELOPMENT OF NUCLEAR ENERGY IN THE PEOPLES REPUBLIC OF BULGARIA (NRB). Georgiev, R. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

18729 (CONF-701074-P1, pp 32-38) DEVELOPMENT OF REACTOR AND NUCLEAR-ENERGY RESEARCH IN THE HUNGARIAN PEOPLE'S REPUBLIC. Ostrovski, D. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

18730 (CONF-701074-P1, pp 54-60) DEVELOPMENT OF ATOMIC ENERGY IN THE POLISH PEOPLE'S REPUBLIC. Andzjevskii, S. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

18731 (CONF-701074-P1, pp 61-68) DEVELOPMENT OF NUCLEAR ENERGY IN THE CZECHOSLOVAK SOCIALIST REPUBLIC. Barabas, K. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

18732 (NP–20244) ANNUAL REPORT, 1973. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m. b. H., Hamburg (F. R. Germany)). 1973. 112p. (In German). Dep. NTIS (US Sales Only) $8.75.

The development work done on the design of the NS Otto Hahn is reviewed, and the fuel reloading and reconstruction of the nuclear installation are described. The studies made on the materials technology for light water reactors are reported. Studies on desalination of sea water and ocean technology are reviewed. High-temperature reactor development is discussed. Studies made in cooperation with industry, other research installations, and universities are outlined. The publications and reports issued during the year are tabulated. (JSR)

18733 (NP-20272) REPORT AND ACCOUNTS OF THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY FOR THE YEAR ENDED 31 MARCH 1974 TOGETHER WITH THE COMPTROLLER AND AUDITOR GENERAL'S REPORT ON THE ACCOUNTS. (UKAEA). 1974. 78p. Dep. NTIS (U. S. Sales Only) $7.00.

Topics discussed are the nuclear program in the UK, work outside the nuclear power program, finance, and staff. The reactor types dealt with are AGR, HTGR, SGHWR, Magnox, LWR, and fast reactors. Controlled nuclear fusion is also discussed. (UK)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 19033, 19040, 19041, 19084, and 19107.

18734 (CONF-701074-P1, pp 385-403) PROSPECTIVE DEVELOPMENTS IN THE VESSEL-TYPE OF BOILING REACTORS WITH NATURAL CIRCULATING COOLANT (ON THE BASIS OF OPERATION EXPERIMENTS OF REACTOR VK-50). Sokolov, I. N.; Filatev, I. A.; Baribkin, V. I.; Evstignev, V. P. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The problems of the hydrodynamics of the natural circulation in the vessel-type reactor (discharge characteristics, gravitational separation of steam, capture of steam in the dipping channel of the circulation loop) are discussed. It has been shown that the use of artificial means in levelling the energy release allows us to reach the average specific voltage of 60 to 70 kW/W. It has also been shown that with high average steam content the limiting factor is the reserve before the crisis of heat exchange, and not the resonance instability in the core. 13 references. (auth)

18735 (CONF-741065-20) NONLINEARITY CONSIDERATION WHEN ANALYZING REACTOR NOISE STATISTICAL CHARACTERISTICS. Kebadze, B. V.; Adamovski, L. A. 1974. 11p. Dep. NTIS (U. S. Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Statistical characteristics of boiling water reactor noises in the vicinity of stability threshold are studied. The reactor is considered as a nonlinear system affected by random perturbations. To solve a nonlinear problem the principle of statistical linearization is used. It is shown that the half-width of resonance peak in neutron power noise spectrum density as well as the reciprocal of noise dispersion, which are used in predicting a stable operation threshold, are different from zero both before and after the stability boundary determined based on linear criteria. (auth)

18736 (CONF-741065-22) SIMPLE SPACE DEPENDENT THEORY OF THE NEUTRON NOISE IN A BOILING WATER REACTOR. Kosaly, G.; Maroti, L.; Mesko, L. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

A simple heuristic model of the neutron noise in a large BWR core is given. The critical flux was assumed to be constant. This assumption is not an essential part of the model and should be removed in further work. As regards the comparison of the results of the model to experimental results, up to now such comparisons were rather successful indicating the validity of the model. It is to be noted though, that all the experimental results used to corroborate the model refer to the Lingen BWR. (auth)

18737 (RT/FI-(74)39) MODIFICATIONS IN CELL CROSS SECTIONS IN THE EPITHERMAL AND FAST ENERGY RANGE DUE TO THE PRESENCE OF Gd AS A BURNABLE POISON. Gabrielli, P. G.; Pistella, F. (Comitato Nazionale per l'Energia

Nucleare, Rome (Italy)). Oct 1974. 22p. Dep. NTIS (U. S. Sales Only) $4.25.

In order to evaluate properly the power generated by the Gd poisoned pins currently used in LWR's, effective cell macroscopic cross sections were calculated parametrically vs. initial Gd content and void content. The results were fitted by proper analytical formulations to be incorporated in the BURNY-BEVE code. (auth)

18738 OPERATING EXPERIENCE OF GERMAN NUCLEAR POWER STATIONS IN 1973. Atomwirt., Atomtech.; 19: No. 10, 506-511(Oct 1974). (In German).

6 figs.

The ABE committee of the German Atomic Forum reports on the operational experience with nuclear power plants in the Federal Republic of Germany in its 1973 annual report. The increase of the atomic current generation compared with the previous year of 28% is the result of a remarkable increase in the availability of nuclear power plants. The most important results are given. (GE)

18739 SMALL CRACKS IN THE REACTOR COOLING SYSTEM. Availability of US Power Plants Reduced. Handelsblatt; 29: No. 183, 3(Sep 1974). (In German).

1 fig.

The USAEC who made the discovery of fine cracks in the cooling system of three boiling water reactors public, ordered the examination of a further 15 nuclear power plants in the USA. (GE)

18740 A CODE TO CALCULATE THE TRANSIENT, THREE-DIMENSIONAL POWER DISTRIBUTION IN LARGE LWR CORES. Schmidt, A. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung; Technische Univ. Muenchen (F. R. German). Lehrstuhl fuer Reaktordynamik und Reaktorsicherheit). Atomkernenergie; 24: No. 1, 20-24(1974). (In German).

5 figs.; 3 tabs.; 4 refs.

A method is described to compute the transient, three-dimensional power distribution in the core of large light-water moderated reactors. Power operational transients may be simulated which are determined by constant system pressure and the thermohydraulic feedback effects to the neutron kinetics. To solve the system of partial differential equations an explicit finite difference method is applied. The properties of boiling water reactors are especially taken into account in the description of coolant behaviour. (auth)

18741 EXPERIENCE IN COMMERCIAL OPERATION OF NUCLEAR POWER STATIONS IN THE FEDERAL REPUBLIC OF GERMANY. Meyer, F. pp 32-61 of Fifth FORATOM Congress. Bonn; Deutsches Atomforum e.V. (1973).

From 5th foratom congress on nuclear power plants in Europe; Florence, Italy (15 Oct 1973). See CONF-731039-.

Operating experiences and availabilities for the RWE-Bayernwerk Reactor, Lingen Reactor, Obrigheim Reactor, and Stade Reactor are reviewed. (DCC)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 18737, 18738, 18741, 19028, 19033–19036, 19053, 19054, 19084, and 19107.

18742 (CENPD-153(Rev.01)) EVALUATION OF UNCERTAINTY IN THE NUCLEAR FORM FACTOR MEASURED BY SELF-POWERED FIXED IN-CORE DETECTOR SYSTEMS. Hellens, R. L.; Lee, R. R.; Stuart, M. R. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 104p.

The in-core neutron detectors now employed in pressurized water reactors serve three important purposes. First, the signals provide a basis for assessing the accuracy attained and the reliance which can be placed on design predictions of the core power distribution throughout the various fuel cycles of the reactor. Second, the in-core signals can be used during plant operation to provide assurance that an adequate thermal fuel margin has been maintained between the operating and limiting conditions. Third, the signals from various regions of the core can be used to ensure that the out-of-core safety instruments and their algorithms provide adequate protection for the fuel. The first step in qualifying the in-core instruments to perform the above functions is the evaluation of the instrument and theoretical uncertainties inherent in inferring the linear heat rating of the fuel, particularly in the region of maximum rating, from in-core data. This report provides such an evaluation for the particular type of instrumentation supplied in C-E reactors, based on operating data from three plants and critical experiments especially performed for this purpose. 5 references. (auth)

18743 (CONF-701074-P1, pp 168-185) RESULT OF A FOUR YEAR OPERATION OF ATOMIC ELECTRIC POWER PLANT OF RHINESBERG. Mentsel, S. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabra 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The Atomic Electric Power Plant of Rhinesburg, the first Atomic Electric Power Plant of the German Democratic Republic, was constructed with the help of the Soviet Union and put into operation on 9th of May, 1966. During the four years of operation the plant has proved to be a reliable and stable source of power. The coefficient of power and the time factor confirm this. Graphs show the generation of electric power and capacity of the electric plant. From this it is possible to determine and analyze the basic shutdown period. The behavior of the main assembly, namely, the reactor, which includes fuel elements, primary circuit secondary circuit and turbines, is examined and corresponding conclusions drawn. (auth)

18744 (CONF-701074-P1, pp 352-361) HIGH-POWER STEAM GENERATORS FOR ATOMIC ELECTRIC POWER PLANTS WITH WATER-MODERATED WATER-COOLED REACTORS. Titov, V. F.; Grishakov, V. I.; Tarankov, G. A.; Suprunov, V. G.; Denisov, V. P.; Stekol'nikov, V. V. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

With growth of the unit capacity of atomic electric power plants the unit capacity of one of the main assemblies of such plants, the steam generator, increases. In that case a number of problems of a thermal engineering and technological nature arise, since, in spite of the substantial increase of unit capacity, the principle of transportability is preserved. The designs of horizontal and vertical steam generators for units of atomic electric power plants with water-moderated water-cooled power reactors with a capacity of 1000 MW(e) and with four circulation loops have been examined. Light has been shed on the principal aspects in the creation of transportable steam generators with a high unit capacity. Substantiations are given for the principal decisions adopted in the development of the main structural assemblies of the steam generators. It is shown that the requirement of increased reliability in the presence of increase of the unit capacities of the equipment of atomic electric power plants, including the steam generators, caused a considerable volume of experimental work to be done in the area of the hydrodynamics of mixtures of steam and water, the separation of steam and the strength of individual structural assemblies. An analysis has been made of the possibilities of creating steam generators with natural circulation of the boiler water with the generation of superheated steam. (auth)

18745 (CONF-701074-P1, pp 372-384) BASIC OPERATING CHARACTERISTICS OF THE REACTOR INSTALLATION OF BLOCK 2 OF THE NOVOVORONEZH ATOMIC ELECTRIC POWER PLANT. Ovchinnikov, F. Ya.; Voronin, L. M.; Samoylov, S. N.; Sedov, V. K.; Malkov, Yu. V.; Markov, Yu. V.; Dukhovenskii, A. S.; Belyaev, A. I. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Block II of the Novovoronezh Atomic Electric Power Plant (AES), with a capacity of 365 MW, was included in the power system of the European part of the USSR at the end of December 1969. The main characteristics of Block II of that AES are presented. An approach is presented toward the selection of the allowable operating conditions of the block, as well as the results of study of the characteristics of certain accidents and transient processes. Information is presented about the influence on the operating characteristics of the reactor of a solution of boric acid in the coolant of the primary circuit, used to regulate activity. (auth)

18746 (CONF-701074-P1, pp 467-477) INTERNAL REACTOR START-UP MEASUREMENT AND OPERATION OF BLOCK 2 OF THE NOVOVORONEZH. Lomakin, S. S.; Morozov, A. G.; Panfilov, G. G. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The parameters of the thermal neutron field were investigated in the measuring channels. Measurements were made with activation detectors of the spectral characteristics and the relative distributions of the thermal neutron flux were measured also with fission chambers and direct charge sensors. Absolute measurements were made on the basis of the activation of thin gold foils. The spectrum and absolute neutron fluxes in the reactor core and around the shell were measured with threshold detectors. Experimental investigation showed the presence of altitude edge effect in the spectral distribution of the neutrons, which must be taken into consideration in measuring the distribution of energy release, and also permitted determining the integral fast neutron fluxes on the reactor shell, knowledge of which is important for its safe operation. 5 references. (auth)

18747 (CONF-701074-P1, pp 478-493) SMALL POWER AND ATOMIC HEATING PLANTS. Bogeanov, N. V.; Kotov, A. P.; Sergeev, U. A.; Turchaninov, V. A. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

With the aim of determining the prospects of developing single-unit nuclear heating plants (ATS) of small power to provide central heating, plants having a capacity of 2 × 12 MW, 2 × 36 MW and 2 × 100 MW were studied. It is proposed to adopt water-cooled, water-moderated reactors for these plants. The planned heating plants are based on a three-circuit technological diagram, which include a reactive (first) circuit, intermediate (second) circuit for the heat transmitting agent and heating circuit (third circuit). The use of such a layout is envisaged in order to exclude all possibilities of radioactive contamination of the thermal circuit. The prospects of developing nuclear heating plants was proposed first of all to be used for remote areas of the USSR. The competitiveness of nuclear heating plants in such conditions is ensured by the fact that practically the expenditure for nuclear fuel is independent of the area where it is to be used, whereas the expenditure for supplying organic fuel to such areas results in a considerable rise in price. Estimations were also carried out to decide the expendiency of constructing nuclear heating plants for the middle-latitude areas of the USSR. (auth)

18748 (RD/B/N-3001(Rev.)) MEASURED BURN-UP DISTRIBUTIONS IN BEZNAU ASSEMBLY 80 AND A COMPARISON WITH WESTINGHOUSE PREDICTIONS. Dawson, J. T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Aug 1974. 20p. Dep. NTIS (U. S. Sales Only) $4.25.

Fuel from Assembly 80 of Beznau 1, PWR reactor, was gamma scanned in order to check Westinghouse's predictions of pin-to-pin burn-up distributions and to provide an experimental basis for checking the predictions of United Kingdom computer codes. The burn-up distributions, measured on a precision Ge(Li) detection system, were obtained from the concentrations of the fission products ^{137}Cs and ^{144}Ce. The results from these two fission products mutually agreed to approximately ±1% (1), indicating no significant errors due to ^{137}Cs migration at the Beznau Assembly 80 fuel center temperatures of under 1200°C. A very simple set of equipment incorporating a NaI detector was used as a quick method of scanning the fuel, and its measured distributions were checked against those from the Ge(Li) rig. It was shown to give accurate measurements (±1½%) of the rather flat pin-to-pin distribution providing temperature drifts were avoided, but it was inadequate for the more peaked axial distribution unless corrections were applied to take account of the vibration in the ^{134}Cs : ^{137}Cs ratio with burn-up. The Westinghouse "predictions" (based on 2-dimensional calculations fitted to in-core flux plots) of the pin-to-pin burn-up distribution in Assembly 80 were shown to be accurate to ±1½% (1), but the burn-up varied by less than 15% across the assembly. One pin J7 was over-predicted by nearly 5%, but this may have been due to the approximate representation of the nearby instrumentation tube used in the Westinghouse calculational method. (auth)

18749 (TID/SNA-101) AEROJET NUCLEAR SYSTEMS COMPANY PROPOSAL NR70058 FOR NEW FUEL ELEVATOR AT ZION STATION. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 18 Mar 1970. 23p. Dep. NTIS $4.25.

18750 (XN-209(Suppl.4)(Rev.1)) DENSIFICATION EFFECTS ON EXXON NUCLEAR PRESSURIZED WATER REACTOR FUEL. Supplement 4 (Revision 1). (Exxon Nuclear Co., Richland, Wash. (USA)). 27 Dec 1974. 28p. Exxon, Richland, WA.

Modifications to the calculational procedures incorporated in the PWR densification model are described which account for: (1) a threshold in fuel pellet burnup below which irradiation-induced UO$_2$ swelling does not affect the pellet dimensions, and (2) the potential for absorption of helium fill gas into the UO$_2$ fuel pellets. Analytical results are also provided which compare fuel and clad temperatures predicted using the computer codes GAPEX and JEREPP. The input data used in the calculations and a general description of the JEREPP code calculational technique are also provided. A comparison of equiaxial grain growth and percent fission gas release calculated using GAPEX to three different experimental values is provided. In each case the comparison indicates that calculations using GAPEX conservatively over-predict the fuel temperature. (auth)

18751 ENERGY SITUATION AND BASF NUCLEAR POWER PLANT. BASF Inform.; No. 8, 10-15(1973). (In German). 10 figs.

The article deals with the importance of the planned nuclear power plants for ensuring the energy supply for the BASF, for the improvement of the environmental relationships in the Rhine-Neckar area by decreasing the emissions and for the profitableness of the BASF production. A time schedule for the winding up of the project is given. Finally, the planned safety technical devices are described, the radiation protection explained as well as the details of the licensing procedure given. (GE)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstract 19107.

18752 (CONF-701074-P1, pp 296-318) DESIGN FEATURES OF THE URANIUM–GRAPHITE CHANNEL-TYPE HIGH POWER REACTOR. Dollezyal, N. A.; Bulkin, U. M.; Polushkin, K. K. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The reactor under description is the heterogeneous, uranium–graphite, channel, boiling type of reactor intended for energy production. Electrical capacity is up to 1.10^6 kW. The coolant used is water and steam–water mixture. The reactor assembly includes: reactor; circuit for multiple, forced circulation; reactor control and shielding system; gas circuit; cooling circuit for side shielding; drainage system; system for cooling the water in cooling pond and other auxilliary systems. (auth)

18753 (CONF-701074-P1, pp 340-351) INCREASING THE POWER OF ATOMIC ELECTRIC POWER BLOCKS. Dollezyal, N. A.; Baturov, B. B.; Koryakin, U. I.; Chernyaev, V. A.; Zakharov, I. I. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

All possible means of increasing the power unit of steam turbo-assemblies have been analyzed. Indications are that the greatest increase of unit power (10 times more), will in theory, be obtained by the use of low-temperature binary cycles. The results of the comparison of economical estimations of the atomic electric power plants with uranium–graphite thermal reactors, using steam–water and water–freon turbo-assemblies have been carried out. It has been observed that starting from 1000 MW electric power plant using steam turbines of 500 MW power and 3000 revolutions/minute, gives a substantial economy in capital investment (more than 10%) per 2000 MW(e) and allows a reduction in the running expenditure for power productions. The basic problems, arising from the realization of low-temperature binary cycles in atomic electric power plants with thermal reactors are discussed. It has been observed, that for solving this problem, serious technological difficulties are not expected. The possibility of creating a water–freon turbo-assembly of power unit of over 2000 MW at 3000 revolutions/minute and twice that power for 1500 revolutions/minute is discussed. (auth)

18754 (CONF-701074-P1, pp 404-422) CONSTRUCTION OF URANIUM–GRAPHITE CHANNEL-TYPE REACTORS WITH TUBE-SHAPED FUEL ELEMENTS AND NUCLEAR SUPER-HEATING OF STEAM. Dollezyal, N. A.; Aleschenko, P. I.; Bulankov, U. V.; Knyazeeva, G. D. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Among the uranium–graphite power reactors using thermal neutrons of channel type that have achieved wide application in the USSR, a special place is taken by the existing reactor of the first atomic electric power plant and Beloyarskaya Atomic Electric Power Plant. The special feature of these reactors is the tube shaped fuel elements, which make it possible to have coolant, in all cases, uncontaminated by the fission products of particles of uranium. (auth)

18755 (CONF-701074-P1, pp 423-448) METHODS OF STARTING AND EXPERIMENTS IN THE OPERATION OF URANIUM–GRAPHITE CHANNEL-TYPE REACTORS WITH TUBE-SHAPED FUEL ELEMENTS AND NUCLEAR SUPER-HEATING OF STEAM. Aleschenkov, P. I.; Zvereva, G. A.; Kireev, G. A.; Knyazeva, G. D.; Kononov, V. I.; Lunina, L. I.; Mitaev, U. I.; Nevskii, B. P.; Polyakov, V. K. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The problems of the methods of start-up and operation of two uranium–graphite channel-type reactors with tube-shaped fuel elements and nuclear super-heating of steam up to 520 + 540°C at 100 atm. pressure, working in the Beloyarskaya Atomic Electric Power Plant, are reviewed. The first reactor of 100 MW(e), works on a two circuit system from 1964, the second, of 200 MW(e), operates on a single circuit system since the end of 1967. A brief description of the technological diagrams of the blocks and distribution of working channels in the core are given. Some information about a reactor for steam parameters up to 250 atm. and 500/540°C is discussed. The advantages of a reactor with nuclear super-heating steam are listed. 8 references. (auth)

18756 (CONF-701074-P1, pp 449-466) REACTOR PHYSICS OF THE BELOYARSK ATOMIC ELECTRIC POWER PLANT. Vikulov, V. K.; Mityaev, U. I.; Shuvalov, V. M. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The question of physical profiling of power release by means of a corresponding distribution of fuel channels with different enrichment of uranium and safety rod channels is discussed. The variation factors of energy release ($K \simeq 1.25$) obtained in reactors of the Beloyarskaya Atomic Electric Power Plant are one of the best in world practice. Justification for shifting to "lightened" regulating rods that secure a more stable distribution of power release is given. Effects of reactance connected with the blowing of steam super-heating channels with steam during the start-up of the station are studied. The special feature of the channel-type reactors is the relative ease with which reloading of the fuel channels, including the continuous loading can be done. The relationship between the burnup fraction in channels and the self cost of electric power against the interval between reloadings is shown. The results of the burnup calculations and change in the effectiveness of the regulating rods made from boron steel are given. (auth)

18757 (CONF-741144-1) STUDY OF THE APPLICATION OF HTGR TO A PETROLEUM REFINERY PETROCHEMICAL COMPLEX. Anderson, T. D.; Spiewak, I. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 11p. Dep. NTIS $4.00.

From BNES international conference on the HTGR process application; London, UK (26 Nov 1974).

The High-Temperature Gas-Cooled Reactor (HTGR) shows promise as a source of industrial energy for certain applications especially in petroleum refining and petrochemical plants. One limitation to the use of large HTGRs for industrial energy stems from the mismatch in size between nuclear plants and most industrial plants. Even very large refineries could use the output of only one HTGR. The size mismatch, coupled with the need for multiple nuclear units to provide reliability, will limit applications to joint uses of a nuclear power station. One desirable arrangement is for an electric utility to generate both electricity for the grid and thermal energy for local industries. In those places where this arrangement can be implemented, the HTGR would have significant economic advantages over alternative fossil energy systems. (auth)

18758 (GA-A-13158) HIGH-TEMPERATURE NUCLEAR HEAT SOURCE STUDY. (General Atomic Co., San Diego, Calif. (USA)). 30 Dec 1970. Contract AT(04-3)-167. 435p. Dep. NTIS $10.60.

The results of a study performed for the U. S. Atomic Energy Commission to investigate the uses of the high-temperature gas-cooled reactor (HTGR) as a process heat source are presented. The capability of the General Atomic Company HTGR to develop high temperatures for process heat is discussed. The design of a nuclear process system for steam-methane reforming at temperatures of 1200°, 1400°, 1600°, 1800°, and 2000°F is described, and the capital and operating costs of the plant are presented. The research and development efforts for fuel materials, special reactor equipment, and design development are discussed in detail in conjunction with their schedules and costs. Predicted capital costs are shown not to vary greatly with temperature, but development time and costs are shown to be large at and above a process heat temperature of 1600°F. The item requiring major development at a process temperature of 1600°F is a ceramic process heat exchanger. Beyond this temperature, a major fuel development program is needed unless an advanced fuel management scheme is adapted for the process heat reactor. (auth)

18759 (NP-20285) O.E.C.D. HIGH TEMPERATURE REACTOR PROJECT DRAGON. Fifteenth Annual Report, 1973–1974. (Organization for Economic Co-Operation and Development, 75 - Paris (France)). 1974. 70p. OECD, Paris.

Information is presented concerning the Dragon reactor support studies and fuel irradiation programs, HTGR fuel and graphite studies, and project administration. (DCC)

18760 (ORNL-TM-4763) INTERIM REPORT ON PCRV THERMAL CYLINDER AXIAL TENDON FAILURES. Whitman, G. D. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 33p. Dep. NTIS $4.00.

A summary is presented of preliminary investigations that were performed on the failure of certain prestressing tendons in a prestressed concrete thermal cylinder model. (auth)

18761 (WANL-2445-1) VERY HIGH TEMPERATURE REACTOR FOR PROCESS HEAT. A Technical and Economic Assessment. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1974. Contract AT(11-1)-2445. 319p. (COO-2445-1). Dep. NTIS $7.60.

A description is given of the conceptual design of a very high temperature nuclear reactor (VHTR) suitable for providing 3000 MW(t) of power, in the form of electricity and heat, to a chemical process operating with a peak temperature of 1600°F. The modifications to the conceptual design to permit reactor ratings of 2000 MW(t) and 4000 MW(t) are presented, as well as those modifications required to permit the reference design to operate at temperature levels consistent with process temperatures varying between 1200°F and 2000°F. The reactor is a helium cooled graphite moderated unit employing the high temperature fuel technology derived from the NERVA nuclear rocket program. The reactor is housed in a prestressed cast iron vessel in which are also located the helium circulators, turbomachinery, and high and low temperature intermediate heat exchangers. An intermediate heat transport system isolates the reactor from the process and enhances the operability, maintainability, and licensability of the nuclear heat source. An economic evaluation of the VHTR Nuclear Island is presented for the reference design conditions, as well as the changes in overall economics for different power levels and process temperatures. The research and development effort required to bring the VHTR to large scale demonstration is also identified. (auth)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstract 19037.

18762 (AI-AEC-13141) DESIGN REPORT: 3000-kwe SUBSEA NUCLEAR POWER PLANT. (Atomics International Div., Canoga Park, Calif. (USA)). 20 Dec 1974. Contract AT(04-3)-701. 46p. Dep. NTIS $4.00.

A subsea nuclear power plant for use in offshore oil and gas fields, capable of generating 3000 kW(e) of electrical power, unattended and continuously, for 4 years, is described. The nuclear power plant consists of three major items: (1) a reactor module, containing the zirconium hydride reactor and primary NaK coolant loop, (2) a generator module, containing the electrical generating equipment and the organic Rankine power conversion system, and (3) a waste heat exchanger, to dissipate the waste heat to the surrounding seawater. A fourth neccessary item, although not a part of the nuclear power plant, is the transportation-emplacement barge, used to transport the nuclear plant to its location and to provide an emplacement vehicle on the ocean floor. The safety aspects of the proposed subsea nuclear plant are compared with commercial light water power reactors. Due to the fact that the subsea nuclear power plant is hermetically sealed, its safety and reliability margins exceed typical commercial plants. The endothermic behavior of the zirconium hydride fuel also precludes any possibility of a fuel meltdown incident. The current development status of each major component is discussed, and the subsea component design criteria are compared with previously tested hardware. (auth)

18763 (CONF-701074-P1, pp 69-81) COMMISSIONING OF POWER STATION A-1: MASS EXPERIMENTS WITH FUEL ELEMENT CASSETTES. Tomik, I. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The application and aim of the mass experiment in start-up of the atomic electric power plant A-I, heavy–water moderated reactor are described. The aim of the mass experiment is: to determine the working ability of fuel element cassettes under conditions of planned burning, as well as determining precisely the maximum parameters of the accepted construction designs; to use special cassettes, intended for physical and thermo-technological experiments, during exploitation; to check experimentally the influence of separate stages of energy strata on the working ability of cassettes; to check and control exploitation parameters of heat-transmission agents in fuel channels; to carry out large scale post-irradiation analysis of fuel elements, details of cassettes, construction materials in relation to the degree of burnup; and to develop methods for post-irradiation analysis and their application in hot laboratories. (auth)

18764 (CONF-701074-P1, pp 99-113) CALORIMETRIC METHOD OF MEASUREMENT OF THE BURN-OUT OF FUEL ELEMENTS OF AEPP A-1. Novak, S.; Budinskii, M.; Beresh, U. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The method of measuring the degree of burnup of separate fuel elements of the A-1 reactor during operation is discussed. The quantity of heat generated in separate fuel elements is determined taking into consideration all the losses on the basis of measurements of the quantity of heat drawn off by gas (indirect method). For measuring the quantity of gas through a separate channel, relationship of channel resistance to the position of conical regulator in the sphere of cold cell and parameters of gas at the input and output of fuel elements is used. The relationship between the changes of isotope composition in fuel and the quantity of heat dissipated from fuel elements is determined. A block diagram of estimated program is presented. (auth)

18765 (CONF-701074-P1, pp 134-149) PREPARATION TO START UP ATOMIC ELECTRIC POWER PLANT A-1. Khorvat, E. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The problems are discussed for start-up of the atomic electric power plant A-I with a reactor type KS-150 (with heavy-water as moderator and carbon dioxide as cooling agent). (auth)

18766 NDT REQUIREMENTS FOR CANDU. Nixon, E. G. (Atomic Energy of Canada Ltd., Sheridan Park, Ont.). Non-Destruct. Test. (Guildford, Engl.); 7: No. 6, 305-309(Dec 1974).

Some of the testing problems posed by the CANDU nuclear reactor system are described. CANDU uses heavy water as moderator and coolant and uses pressure tubes rather than a pressure vessel. It has much in common with the British steam generating heavy water reactor. The Canadians have modified the nuclear code of the American Society of Mechanical Engineers for their own needs. (auth)

Power Reactors, Breeding

Refer also to abstracts 16676, 16677, 18794, 19030, 19031, 19038, 19042, 19044, 19045, 19048, 19085, 19087, and 19107–19109.

18767 (ANL-CT–75-19) PRELIMINARY ANALYSIS OF TEMPERATURE AND PRESSURE FLUCTUATIONS IN MIXING TEES WITH INLET-LEG PIPE REDUCERS. Kasza, K. E. (Argonne National Lab., Ill. (USA)). Dec 1974. Contract W-31-109-eng-38. 53p. AT.

Recent findings on the thermal-hydraulic behavior of coolant mixing tees fitted with inlet-log pipe reducers are discussed. Temperature and pressure fluctuations were observed which could subject a piping system to mechanical vibrational fatigue in addition to thermal fatigue. A flow model and analytical expressions are presented which explain and predict much of the observed data. (DG)

18768 (ANL-RDP–33) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, OCTOBER 1974. (Argonne National Lab., Ill. (USA)). 6 Dec 1974. Contract W-31-109-eng-38. 183p. AT.

Progress is reported in the following areas: (1) EBR-2 operation and testing; (2) LMFBR design support; (3) instrumentation and control; (4) fuels and materials development; (5) reactor physics; (6) reactor safety; and (7) GCFR studies. (JWR)

18769 (ANL-Trans–964) CARBIDE FUEL ELEMENT WITH HELIUM BOND FOR FAST REACTORS: PROBLEMS RAISED BY FUEL SWELLING. Mikailoff, H. Translated from Bull. Inform. Sci. Tech. (Paris); No. 196, 49-54(1974). 14p. Dep. NTIS $4.00.

Experimental data indicated that a clad carbide fuel element with helium bonding exhibits in-pile behavior profoundly different from oxide fuel as presently adopted for fast reactors. Under similar irradiation conditions (a linear heat rating of about 600 W/cm), carbide undergoes notably greater swelling than the oxide–about 2.5% per at.% burnup compared to 0.75% per at.% burnup in the oxide. Due to fission gas precipitation in the bubbles which remain in the carbide and coalesce at about 1100°C, swelling increases greatly with temperature, which is not the case in the oxide. Cladding deformation was observed in all experiments. Deformation is observable after low irradiation and increases quite slowly with burnup. The experimental results indicate that it will certainly be difficult to develop a clad helium-bonded carbide capable of attaining high burnups with sufficient safety. (auth)

18770 (CONF-701074-P1, pp 561-579) PHYSICAL CHARACTERISTICS OF THE BOR-60 REACTOR. Kazachkovskii, O. D.; Alekseev, I. N.; Baranov, S. M.; Karatsuba, Yu. M.; Krasnoyarov, N. V.; Lychagin, V. N.; Fofanov, V. S. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The results of critical experiments in the process of the physical start-up of the BOR-60 reactor, measurement of the effectiveness of regulating devices and the spatial irregularity of energy release over the apparatus, and also the results of investigation of various effects of reactivity in bringing the installation to on-power operation are presented. (auth)

18771 (CONF-701074-P1, pp 580-596) EXPERIMENTAL ANALYSIS OF ACTIVITY DISTRIBUTION IN THE REACTOR BOR-60. Krasnoyarov, N. V.; Cryazev, V. M.; Chechetkin, Yu. V.; Cadziiev, G. I.; Polyakov, V. I.; Fofanov, V. S.; Kobzar, I. G.; Ribakov, V. N. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Questions arising out of experimental analysis of radiation distribution along the reactor shield are discussed, the level of activity of the sodium coolant is estimated, the radiation fields in the productive rooms of the assembly are reviewed, and results of analysis of radioactivity in the gaseous cavity of the circuit are discussed. The results obtained can be used for checking the calculated methods of shielding and distribution of activity along the fuel circuits of fast reactors, as well as for deciding a series of other practical problems. (auth)

18772 (CONF-701074-P1, pp 597-617) SELECTING THE PARAMETERS FOR THE LARGE FAST REACTOR. Kazachkovskii, O. D.; Krasnoyanov, N. V.; Nikolskii, R. V.; Grachev, E. A.; Ziganshin, T. M.; Krillov, E. V.; Sekletzova, R. E. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

One of the most important problems in the development of nuclear power is the production of the large fast reactor. The results of a series of computed studies carried out basically for selecting the parameters of such a type of atomic electric power plant are presented. Certain physical and economical characteristics of reactors with metal and oxide fuels are discussed. The question of selecting the optimum temperature of the heat transmitting agent is studied. Questions connected with selection of the profiling of the fields of energy release and temperature and the optimum thickness of the screen are also discussed. (auth)

18773 (CONF-701074-P1, pp 656-681) SINGLE-PASS STEAM GENERATOR WITH SODIUM COOLANT. Stekol'nikov, V. V.; Bagdasarov, Yu. E.; Titov, V. F.; Bogdanovich, P. N.; Kulikov, E. V.; Fedorov, L. F.; Poplavskii, V. M. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The design of a vessel-type sodium-cooled steam generator with a thermal capacity of about 500 MW for the production of high-pressure superheated steam is presented. The vessels of the evaporator and steam superheater are formed separately, and the surfaces of the main and intermediate superheaters are combined in a single vessel. The heat exchange surface in both vessels is assembled in the form of flat plates made of coils of S-shaped form. (auth)

18774 (CONF-701074-P1, pp 682-706) MEASUREMENT OF THE SODIUM FLOW RATE AND LEVEL IN FAST POWER REACTORS. Taranin, V. D.; Petrenko, A. A.; Kuznetsov, I. A.; Danilov, M. A.; Loginov, N. I.; Tavrovskii, I. I.; Radchenko, V. A. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The precise measurement of the sodium flow rate by means of large electromagnetic flowmeters and also measurements of the sodium level at high temperatures at pressures of 0 to 6000 mm are analyzed. A schematic diagram is presented of a metrological flow meter stand which permits testing magnetic flow meters with an upper limit of measurement of 4000 m^3/hr of liquid sodium, and the main specifications for components of the stand are formulated. The design of a high-temperature sodium levelmeter is described and a schematic diagram is presented. The results of adjustment and resource tests of the instrument on the sodium stand of the BR-5 reactor are presented. 7 references. (auth)

18775 (CONF-701074-P1, pp 707-721) EXPERIMENT IN REACTION AND START-UP OF THE REACTOR BOR-60. Leipunskii, A. I.; Kazachkovskii, O. D.; Baturov, B. B. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

In December, 1969 the power reactor BOR-60 was put into commission. On the basis of experiments the separate units of the reactor, its stages of construction and assembly are discussed. The sequence and results of starting-adjusting jobs on the basic sodium circuits, experiments in the preparation of the heat transmitting agent and its purification from admixtures is described. The problems encountered and the measures taken to adjust them are presented. The conditions under which the loading of the core were carried out during the physical start-up of the reactor are cited. 12 references. (auth)

18776 (CONF-741065-13) DETECTION METHODS DEVELOPMENT. Fry, D. N.; Sides, W. H. (Oak Ridge National Lab., Tenn. (USA)). 1974. 26p.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Temperature-noise monitoring at the outlet of fuel bundle 5B in the FFM was investigated as a means for detecting coolant channel blockage. Exit-rake thermocouple signals were recorded in analog form on magnetic tape to allow off-line analysis. The analog tape recorded signals were later converted to digital form and processed with a fast Fourier transform algorithm to obtain temperature-noise frequency spectra. In addition to spectrum analysis, the amplitude distributions of the fluctuations were also studied. (auth)

18777 (CONF-741065-42) DYNAMIC HEAT TRANSFER EXPERIMENTS IN AN ELECTRICALLY HEATED LMFBR FUEL ELEMENT MOCKUP. Fry, D. N.; Kerlin, T. W.; Sides, W. H. (Oak Ridge National Lab., Tenn. (USA)). 1974. 3p. Dep. NTIS $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Results from experiments performed at the Fuel Failure Mockup Facility to provide heat transfer and fluid flow data in simulated LMFBR fuel bundles operated with and without flow blockages are discussed. (DG)

18778 (GEAP-13825-10) INSTRUMENTATION DEVELOPMENT. Tenth Quarterly Report, April–June 1974. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jul 1974. Contract AT(04-3)-893. 33p. AT.

This is the tenth in a series of reports covering the development of instrumentation for surveillance of the core and in-vessel components of liquid metal fast breeder reactors. Current development efforts are focused on high temperature neutron detectors and reactivity monitoring systems. (6 references) (auth)

18779 (GEAP-13825-11) INSTRUMENTATION DEVELOPMENT. Eleventh Quarterly Report, July–September 1974. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Oct 1974. Contract AT(04-3)-893. 16p. AT.

The development of instrumentation for surveillance of the core and in-vessel components of liquid metal fast breeder reactors is reviewed. Current development efforts are focused on high temperature neutron detectors and advanced signal transmission methods. (auth)

18780 (HEDL-SA-750) FAST BREEDER REACTOR FUEL CLADDING. Lobsinger, R. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 32p. (CONF-740962-1). Dep. NTIS $4.75.

From meeting of the Welded Steel Tube Institute; Cleveland, Ohio, USA (18 Sep 1974).

Energy consumption projections are discussed which emphasize the need for breeder reactor utilization. Fast breeder core design considerations are discussed, and the FFTF is described. Fuel cladding inspection techniques and quality control methods are examined. (DG)

18781 (KFK-2057) FISSION GAS BEHAVIOR IN OXIDE FUEL ELEMENTS OF FAST BREEDER REACTORS. Zimmerman, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Oct 1974. 86p. (In German). Dep. NTIS (U. S. Sales Only) $7.50.

The fission gas behavior in oxide fuel elements irradiated within the irradiation program of the Fast Breeder Project at the Karlsruhe Nuclear Research Centre is reported and discussed. The fuel elements were irradiated in the reactors FR 2 in Karlsruhe, BR 2 in Mol, DFR in Dounreay, and Rapsodie in Cadarache. The amount of fission gas was measured in 3 steps as released fission gas, fission gas retained in bubbles and pores, and fission gas retained in very small intragranular bubbles and crystal lattice sites. This was done by piercing the fuel rods, by grinding the fuel, and by chemical solution of the powdered fuel, respectively. Results are presented. (34 references) (auth)

18782 (KFK-2069) CROSS CORRELATION OF NEUTRONIC AND ACOUSTIC NOISE SIGNALS FROM LOCAL BOILING. Wright, S. A.; Albrecht, R. W.; Edelmann, M. F. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Oct 1974. 38p. (CONF-741065-3). Dep. NTIS (U. S. Sales Only) $5.00.

From EACRP specialist meeting on SMORN reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

A boiling simulator was constructed to model the void and pressure effects of local boiling in an LMFBR. By forcing superheated steam into subcooled water the boiling simulator produced a series of single bubbles separated by waiting times. The bubbles ranged from one to four centimeters in diameter and had lifetimes on the order of 60 milliseconds, and waiting times of 90 milliseconds. The boiling simulator was placed in the core of a zero power reactor (GfK, ARK), and the neutron and pressure signals were recorded and cross correlated. The neutron-pressure cross correlation exhibited an almost perfect correlation at the bubble repetition frequency (7 Hz). If (as expected) the normal pressure and reactivity background noises in a power reactor are uncorrelated, then this strong correlation will improve the signal-to-noise ratio of a boiling detection scheme. Other advantages of the cross correlation technique are that only simple linear transfer functions are necessary to relate the neutronic noise to the pressure noise and that the zone of the reactor (positive or negative void coefficient zone) can easily be determined. Because of these advantages, the neutron-pressure cross correlation technique is considered a serious alternative for the detection of local boiling in sodium cooled reactors. (9 references) (auth)

18783 (NEIC-RR-50) FAST BREEDING REACTORS. Bibliography, 1970–1971. Kowalski, A.; Oleszczak, A. (comps.). (Nuclear Energy Information Center, Warsaw (Poland)). 1973. 113p. Dep. NTIS (U. S. Sales Only) $8.75.

The present Bibliography on Fast Breeder Reactors is the continuation of the compilation published by Nuclear Energy Information Center in NEIC-RR-48 Review Report No. 48. This Bibliography includes 1095 references registered in the Nuclear Science Abstracts vol. 25 in 1971 year. The Subjects Index and Reactors Index are given in this Bibliography. (auth)

18784 (ORNL-5014) INTERIM GUIDELINES FOR DETAILED INELASTIC ANALYSIS OF HIGH-TEMPERATURE REACTOR SYSTEM COMPONENTS. Corum, J. M.; Greenstreet, W. L.; Liu, K. C.; Pugh, C. E.; Swindeman, R. W. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 128p. AT.

This is the second in a series of reports by the ORNL High-Temperature Structural Design Methods for Liquid-Metal-Cooled Fast Breeder Reactor Components Program giving currently recommended guidelines for analyzing the inelastic behavior of reactor system components. Constitutive equations are presented in multiaxial forms for describing time-independent elastic-plastic behavior and time-dependent creep behavior of types 304 and 316 stainless steel. The recommended procedures are similar to those initially given in ORNL-TM-3602, but they are formulated with more generality to allow the analyst some leeway in treating particular situations. New in this report is a chapter that describes the basic observed features of high-temperature deformation behavior that influence the selection of the recommended procedures. Also included is a chapter on guidelines for verification and qualification of inelastic analysis computer programs through benchmark problem calculations. (6 references) (auth)

18785 (WAPD-TM-1117) BMU SERIES OF ^{233}U FUELED CRITICAL EXPERIMENTS (LWBR DEVELOPMENT PROGRAM). Mitchell, J. A. (ed.). (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Jan 1975. Contract AT(36-1)-GEN-14. 55p. Dep. NTIS $5.75.

Eight ^{233}U fueled critical assemblies were studied as part of the Light Water Breeder Reactor Development Program. This series of cores investigated fuel zoning, coupling between modules, the temperature defect, and power flattening. Emphasis in this document is on presentation of the experiments with only a few calculations included. 19 references. (auth)

18786 (WARD-HT–3045-7) VALIDATION OF HIGH TEMPERATURE DESIGN METHODS AND CRITERIA. Quarterly Progress Report for Period Ending August 31, 1974. Bishop, E. C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Nov 1974. Contract AT(11-1)-3045. 194p. AT.

Research on the inelastic behavior and strain tolerances of types 304 and 316 stainless steel base materials for LMFBR components is reported. Tesing of basic and tubular specimens is described as well as structure testing of the Multiloading Test Facility. Testing of the FFTF intermediate heat exchanger inlet nozzle is discussed. Improvements made in the various structural analysis codes used are summarized. Progress in crack propagation testing is reviewed. (JWR)

18787 CARBON-TRAP ALLOYS FOR LIQUID SODIUM. Armijo, J. S. US Patent 3,853,700. 10 Dec 1974. Filed date 2 Nov 1973. 4p.

Special binary alloys (Fe–Ti, Fe–V, Fe–Mn) possess the optimum kinetic and thermodynamic properties which make them efficient carbon traps for full-flow liquid sodium-cooled system, and thus can be effectively utilized to protect heat exchangers from damage due to carburization during sodium circulation. These alloys do not require heating above normal operating temperatures, for efficient carbon trapping. (Official Gazette)

Research, Test, and Experimental Reactors

Refer also to abstracts 16638, 18768, 18780, 18785, 18786, 18975, 19029, 19043, 19061, and 19087.

18788 (AEEW-M-1272) ZEBRA MULTI-CHAMBER SCANNING SYSTEM. Batt, R. G.; Goodings, A.; Marshall, J.; Sanders, J. E.; Sweet, D. W. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Jul 1974. 14p. Dep. NTIS (U. S. Sales Only) $4.00.

The Multi-Chamber Scanning System developed for the zero-power fast reactor Zebra comprises an integral array of 150 parallel-plate fission chambers loaded into fuel elements in a similar manner to standard core components. The chamber outputs are counted sequentially under computer control to provide a rapid three-dimensional power mapping facility. The basic concept, design and calibration of the fission chambers, design of the electronics and computer interface, and overall system performance as exemplified by measurements on a mock-up of the core of the Prototype Fast Reactor are described. (auth)

18789 (BARC-768, pp 143-151) PULSED FAST REACTOR PROJECT. Iyengar, P. K.; Srinivasan, M.; Nargundkar, V. R.; Subba Rao, K.; Chandramoleshwar, K.; Pasupathy, C. S.; Das, S.; Basu, T. K.; Job, P. K.; Paramasivan, C. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

Fast reactor physics experiments being carried out in the PURNIMA reactor to study the characteristics of neutron reflectors for the Kalpakkam LMFBR Reactor are described. (DCC)

18790 (CONF-701074-P1, pp 494-514) EXPERIMENTAL FAST NEUTRON REACTOR ZRR AND SUGGESTIONS FOR ITS EXPERIMENTAL OPERATIONS. Pashek, M.; Tluchgorzj, Z.; Khlumskii, V. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The Czechoslovak organizations, in cooperation with FEI (Obninsk), started to install in 1969 an experimental fast neutron reactor ZRR up to 60 MW. Design parameters and experimental facilities of the reactor are described. (auth)

18791 (CONF-701074-P1, pp 618-633) EXPERIMENTAL STUDY OF METHODS OF DETECTING RUPTURES IN NON-HERMETICALLY SEALED FUEL ELEMENTS OF THE BR-5 REACTOR. Aristarkhov, N. N.; Efimov, I. A.; Mamaev, L. I.; Nikulin, M. P. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The system for verification of the hermetic seal of packets of the BR-5 reactor is described. The main results are presented of two mass verifications of the hermetic seal of working packets containing plutonium dioxide fuel elements, carried out in 1961 and 1965. Some regularities of the escape of gaseous fission products from fuel elements not hermetically sealed are described. A description is presented of the method of unloading, storage and monitoring the hermetic seal of packets of plutonium dioxide and uranium carbide in cans containing molten sodium, and also the results of verification outside the reactor under a layer of sodium of packets of the monocarbide zone of the BR-5 reactor. (auth)

18792 (CONF-741065-17) NEUTRON GENERATION TIME OF THE REACTOR "CROCUS" BY AN INTERVAL DISTRIBUTION METHOD FOR COUNTS COLLECTED BY TWO DETECTORS. Haldy, P. A.; Chikouche, M. (Ecole Polytechnique Federale, Lausanne (Switzerland)). 1974. 6p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The distribution of time intervals between a count in one neutron detector and the consecutive event registered in a second detector is examined and a probability generating function is derived. The theory was then used in determining the neutron generation time in the CROCUS Reactor. (JWR)

18793 (CONF-741065-27) DATA ACQUISITION AND PROCESSING SYSTEM FOR REACTOR NOISE ANALYSIS. Costa Oliveira, J.; Da Veiga, C. M.; Trigueiros, D. F.; Pombo Duarte, J. (Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares). 1974. 31p. Dep. NTIS (US Sales Only) $4.75.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

A data acquisition and processing system for reactor noise analysis by time correlation methods is described, consisting in one to four data feeding channels (transducer, associated electronics and V/f converter), a sampling unit, a landline transmission system and a PDP 15 computer. This system is being applied to study the kinetic parameters of the "Reactor Português de Investigação," a swimming-pool 1 MW reactor. The main features that make such a data-acquisition and processing system a useful tool to perform noise analysis are: (1) the improved characteristics of analog-to-digital converters employed to quantize the signals; (2) the use of an on-line computer which allows a great accumulation and a rapid treatment of data together with an easy check of the correctness of the experiments; and (3) the adoption of the time cross-correlation technique using two detectors which by-pass the limitation of low efficiency detectors. (auth)

18794 (CONF-741212-3) NUCLEAR DETECTION INSTRUMENTATION FOR RSP MEASUREMENTS WITH THE FFTF ENGINEERING MOCKUP CORE. Mathis, M. V.; De Lorenzo, J. T.; Chiles, M. M.; Mihalczo, J. T. (Oak Ridge National Lab., Tenn. (USA)). 26 Nov 1974. 20p. Dep. NTIS $4.00.

From 14th scintillation and semiconductor symposium; Washington, District of Columbia, USA (11 Dec 1974).

Four multichannel detection systems operating in integrated current and pulse modes within the mockup of the Fast Flux Test Facility (FFTF) reactor successfully furnished signals during a five-month Reactivity Surveillance Procedures (RSP) experiment for evaluation of reactivity measurement methods and associated instrumentation for LMFBR applications and low level flux monitor (LLFM) designs for the FFTF. (auth)

18795 (HEDL-TME-71-69) GAS BUBBLE DISPERSION TEST: REACTOR INLET MODEL. (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1971. Contract AT(45-1)-2170. 20p. AT.

Gas bubble dispersion tests were performed using a hydraulic model of the FFTF inlet reactor plenum. These tests were performed to evaluate effective breakup and dispersion of noncondensable gases entering that region. The tests and results are described. (auth)

18796 (HEDL-TME-73-87) FINAL RADIAL SHIELD ORIFICE TEST. Williams, L. S. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-2170. 30p. AT.

The final hydraulic testing performed in support of the engineering design of the orifices for the FFTF radial shields is described. The end use of all the test data was the engineering design prediction of the final orifice size which would deliver the desired flowrates to the radial shield in the FFTF. (auth)

18797 (RN-S-0124) FINAL TEST SPECIFICATION FOR PLUM BROOK REACTOR FACILITY (PBRF) IRRADIATION CYCLE NO. 21. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1964. 14p. Dep. NTIS $4.00.

18798 (UCRL-51423) SAFETY ANALYSIS REPORT FOR LIVERMORE POOL TYPE REACTOR. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Sep 1974. 595p. Dep. NTIS $32.75.

Information on the LPTR reactor is presented concerning the site, design parameters, reactor coolant system, engineered safety features, instrumentation and controls, electrical systems, auxiliary systems, experimental systems, radioactive waste management, radiation protection, operations, accident analysis, technical specifications, and quality assurance. (DCC)

18799 (WANL-TME-562) PRELIMINARY PROGRAM PLANNING DETAILS FOR THE PLUM BROOK REACTOR FACILITY, CY 1964. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1963. 16p. Dep. NTIS $4.00.

WANL has plans to use the HT-1 (horizontal through hole No. 1) of the Plum Brook Reactor on a continuing basis. A description of WANL irradiation test items, the irradiation required, conditions of the irradiation and other pertinent information is provided. (LTW)

18800 (WANL-TME-585) CONCEPTUAL DESCRIPTION OF W-2-1 WATER LOOP. Newby, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 31 Oct 1963. 7p. Dep. NTIS $4.00.

An in-pile, water-cooled loop for short term irradiation testing at high flux levels in the Plum Brook Reactor Facility is described. It is designed for specimen insertion and removal within a reactor operating cycle, is independently water-cooled (with demineralized water) to allow experiments with fuels, etc. and provides storage outside the reactor for irradiated items. All critical facility parameters such as flows, temperatures, pressures, etc. will be measured with instrumentation, controlled within prescribed limits and equipped with alarm systems in conjunction with the requirements of PBRF. (LTN)

18801 (WANL-TME-591) INSTALLATION REQUIREMENTS AND INSERTION PROCEDURES. Jacobs, D. C.; Glassmire, C. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Nov 1963. 31p. Dep. NTIS $4.75.

Insertion procedures, installation requirements and instrumentation of the GETR trail cable facility, used for irradiating fuel materials, is described. (LTN)

18802 (WANL-TME-965) HOT LABORATORIES CAPABILITIES AT THE PLUM BROOK REACTOR FACILITY. Freas, D. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Sep 1964. 46p. Dep. NTIS $5.50.

The proposed WANL program for post-irradiation studies of a variety of irradiation experiments is described, both with respect to the available Plum Brook Hot Cell capability and the anticipated WANL requirements. The following studies, directed to an evaluation of radiation stability as well as operational performance, are scheduled: investigation of the electrical and mechanical operational behavior of irradiated components, determination of the effects of radiation on electrical and mechanical properties, determination of the radiation-induced property changes in reactor structural materials, and investigations of the radiation behavior of NERVA fuel. To conduct these studies, normal hot cell operations required for component disassembly, macro-examinations, physical testing, metallographic studies, and storage will be utilized. These studies will require the use of much of the standard PBRF hot cell equipment as well as the special testing devices and instruments described in this report. (auth)

18803 (WANL-TME-1116(Rev.)) PRELIMINARY TEST SPECIFICATION FOR STRAIN GAGES TO BE IRRADIATED AT THE PLUM BROOK REACTOR 23/W408. Kaining, L.; Pappas, T. A.; Rothleder, B. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1965. 8p. Dep. NTIS $4.00.

18804 (WANL-TME-1530) FINAL TEST SPECIFICATION STRUCTURAL MATERIALS TEST 37/W405. Levine, P.; Coombe, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1966. 30p. Dep. NTIS $4.50.

18805 (WANL-TME-1627) NUCLEAR HEATING MEASUREMENT ACCURACY (RE-4). Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Jun 1967. 42p. Dep. NTIS $5.25.

The uncertainty in heat generation rate measurement using calorimetry is shown to be equal to or less than ±6.4% between 3 and 7 watts/gm. This includes calorimeter accuracy and the uncertainty in the correction from gamma energy flux incident on the calorimeters to that incident on specimens to be irradiated in a cryogenic capsule. It is concluded that these calorimeter measurements will significantly increase the knowledge of nuclear heating in HT-1 (horizontal through Hole No. 1 at the Plum Brook Reactor Facility), and it is recommended that they be made. (auth)

18806 (WANL-TME-1631) FINAL TEST SPECIFICATION FOR NUCLEAR HEATING MEASUREMENT RE-4. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1967. 9p. Dep. NTIS $4.00.

Final test specifications are given for an experiment to measure the spatial radiation heat generation rate at 16 axial positions in the HT-1 loop of the Plum Brook Reactor at full power. Three cylindrical aluminum calorimeters will be enclosed in one container maintained at 1 mm Hg during the test and the temperature measurements made with thermocouples. The predicted heating rates are 3.5 to 5.5 W/g. (LTN)

18807 (WANL-TME-1710) NUCLEAR HEATING MEASUREMENT IN THE PLUM BROOK REACTOR (RE-4). Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1967. 128p. Dep. NTIS $9.50.

An aluminum pedestal type calorimeter was used to measure nuclear heat generation rates in HT-1 (Horizontal Through Hole No. 1) of the Plum Brook Reactor Facility. The nuclear heating rate on the HT-1 axis at the core North–South vertical midplane averaged 3.73 watts/gm over the eight days that it was measured with a maximum of 3.78 watts/gm, when the reactor control rod bank position was near 23 inches. The nuclear heating measurement at this location is shown to be accurate to ±7.5% at the 95% confidence level. (auth)

18808 (WANL-TME-1892) FINAL TEST SPECIFICATION WASPALOY MATERIALS TEST 37/W412. Coombe, J.; Shogan, R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1969. 8p. Dep. NTIS $4.00.

18809 (WANL-TNR-119) EXPERIMENT DESIGN MANUAL AND HAZARDS ANALYSIS PLUM BROOK REACTOR FACILITY. Expt. No. 63-05. Newby, D.; Stephens, A.; Cadoff, H.; Solberg, D.; Neville, R.; Aiken, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1963. 153p. Dep. NTIS $10.75.

The basic purpose of the Plum Brook Reactor Facility and the experimental system described is to provide information which will assist in the selection of materials and components for incorporation in the NRX (Nuclear Reactor Experiment) reactor currently being designed. The radiation environment to which many of the test items will be exposed in their NRX application exceeds that available in any operating test reactor. The radiation levels in the PBRF HT-1 facility are considered the closest available to the actual NRX levels. An important consideration is that many of the radiation effects which are of interest are those associated with dose rate rather than total integrated dose. The items to be tested include samples of instruments, and complete component assemblies. The component assemblies, in many cases, are diagnostic transducers which must be relied upon to provide dependable data during full scale NRX reactor tests. A significant aspect of such transducer testing is, therefore, the need to study the dynamic operation of these transducers under the previously described conditions, in addition to merely determining their gross resistance to failure. This requires that the experimental system include the necessary facilities for activation of the transducers. The nature of the items to be tested and the type of test fixtures required to support and activate them will vary considerably. Since the nuclear and thermal characteristics of all conceivable test assemblies cannot be predicted at this time, the approach has been to analyze the system assuming certain "envelope" values for the test assemblies given below. It is anticipated that for any specific experiment conformance to the "envelope" can be demonstrated by calculation, MUR experiments, or comparison with previous experiments. (auth)

18810 (WANL-TNR-173) EXPERIMENT DESIGN MANUAL AND HAZARDS ANALYSIS PLUM BROOK REACTOR FACILITY. Expt. No. 63-05 RI. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 209p. Dep. NTIS $13.50.

The basic purpose of the Plum Brook Facility and the experimental system described is to provide information which will assist in the selection of materials and components for incorporation in the NRX (NERVA Reactor Experiment) reactor currently being designed. At present, there is insufficient information on the performance of many items in the high radiation environment required in the NRX reactor system. The radiation levels in the PBRF HT-1 facility are considered the closest available to the actual NRX levels. An important factor also, is that many of the radiation effects which are of interest are those associated with dose rate rather than total integrated dose. The water-cooled capsule which will be installed in the HT-1 facility of the PBRF to utilize this high radiation environment is described. The items to be tested in this include samples of instruments, as well as complete component assemblies. The nature of the items and the type of test fixtures required to support and actuate them will vary considerably. In many cases, the component assemblies are diagnostic transducers which must be relied upon to provide dependable data during full-scale NRX reactor tests; therefore, it is necessary to study the dynamic operation of these transducers under the previously described conditions, in addition to merely determining their gross resistance to failure. This, therefore, requires that the experimental system include the necessary facilities for actuation of the transducers. Many experiments are described in detail. (auth)

18811 (WANL-TNR-221) OPERATIONS MANUAL PLUM BROOK REACTOR FACILITY. Experiment 62-16. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1967. 222p. Dep. NTIS $14.25.

The basic purpose of the water-cooled experimental system described is to provide information which will assist in the selection of materials and components for incorporation in the NRX (NERVA Reactor Experiment) reactor currently being designed. The radiation levels in the PBRF HT-1 facility are considered the closest available to the actual NRX levels. An important factor is that many of the radiation effects which are of interest are those associated with dose rate rather than total integrated dose. The basic purpose of the cryogenic inpile loop is to provide a high flux, low temperature environment in which proposed NRX materials and components can be performance tested. Neutron and gamma radiation effects testing has previously been conducted at high neutron and gamma fluxes but ambient temperature. Typical items to be tested in each system would include materials, instrumentation components such as accelerometers, displacement transducers, and strain gages and small mechanical components such as control drum assemblies and dynamic bearings. This manual contains procedures for the checkout, startup, operation and shutdown of the W-1 Cryogenic System and the W2-3 Water-Cooled System. Since the experiments performed in the W-1 and W2-3 systems will differ, and since each system will perform varied experiments, procedures for the conduct of experiments must be written for each test individually. These procedures will be prepared for each experiment by WANL-PBRF-TO and submitted to PBRF for review and approval prior to insertion of the experiment into HT-1. The procedures will include checkout, operation and disposition of each test in accordance with the provisions of this manual. (auth)

Production and Materials Testing and Processing Reactors

Refer also to abstracts 16638, 18757, 18758, and 19115.

18812 (GKSS-74/E/37) NEUTRON RADIOGRAPHY AT THE GEESTHACHT RESEARCH REACTOR AND ITS USE IN IRRADIATION EXPERIMENTS. Greim, L.; Greim, M.; Schumacher, G. W. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 24p. (In German). Dep. NTIS (US Sales Only) $4.50.

At the Geesthacht there are two neutron radiographic devices for nondestructive material studies. The GENRA I has a collimation ratio of 1:375 and a circular image area with a diameter of 18 cm. The thermal neutron flux is 0.8×10^7 n/cm^2 sec. The underwater installation GENRA II has a collimator length of 200 cm. The collimation ratio can be varied from 1:50 to 1:1000 by the use of various shields. The image area is 10×40 cm^2. Objects with a diameter of 10 cm up to a length of 170 cm can be neutrographed in sections of 40 cm. In this technique the indirect method with Dy and In are used. It has a thermal flux of 0.6×10^7 n/cm^2 sec. Examples of the results obtained with these two installations are given. (tr-auth)

Propulsion and Package Reactors

Refer also to abstracts 16350–16357, 16360, 16362–16379, 16381–16386, 16477, 16483–16486, 16582, 16583, 16620, 16622, 16648, 16654–16669, 16680–16689, 16691–16701, 17008, 17030, 17034, 17036–17039, 17112, 17113, 17126, 17150–17156, 17223–17225, 17228, 17496, 17497, 17500–17513, 17530, 17535–17538, 17541–17544, 17578, 17586, 17589, 17592–17595, 18809–18811, 19046, 19049–19051, 19071–19073, 19086, 19088–19095, and 19113.

18813 (AGC-808N-TP) TEST PLAN FOR HYDROSTATIC PROOF TEST OF THE NRX-A ALUMINUM PRESSURE VESSEL S/N 0000002. Smith, L. M. (Aerojet-General Corp., Sacramento, Calif. (USA)). 3 May 1963. 36p. Dep. NTIS $5.00.

18814 (AGC-7730-0006R) ANALYSIS OF THE ENGINE RESONANCE SURVEY IN THE TRANSVERSE DIRECTION AT 3°-45′ (SERIES I) OF THE VIBRATION SURVEY OF XECF IN ETS-1. Jellison, J. E.; Tow, D.; Rosser, R. C. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1968. 95p. Dep. NTIS $7.75.

A complete analysis of the engine transverse resonance survey test, test results, supporting dynamic analyses, and conclusions is presented. This test was Part I (Series I) of the vibration survey of XECF conducted in three parts at ETS-1 in December 1967 and January 1968 by AGC and WANL. (auth)

18815 (GKSS-74/E/28) HEAT TRANSFER TIME CONSTANT OF A FUEL PIN MEASURED BY CROSS-CORRELATION METHODS. Puch, B.; Robinson, E. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F.R. Germany). Inst. fuer Physik). 1974. 2p. INIS.

4 figs.; 4 refs. Also published in Atomwirtsch., Atomtech. (Apr 1974) v. 19(4) p. 181-182.

The research instrumentation of the first core of the "Otto Hahn" reactor FDR included a set of high-temperature thermocouples built in different fuel pins. In a simplified model the heat transfer from the fuel to the coolant is dependent on the heat resistance between fuel and coolant and the heat capacity of the fuel. (GE)

18816 (NTO-R-0007) NRX-A2 ASSEMBLY AND PREPARATION FOR TESTING. Final Issue. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 16 Oct 1964. 67p. Dep. NTIS $6.50.

The NRX-A2 Test Assembly was prepared during July and August, 1964. In general, the assembly and preparation for testing was carried out as planned without major problems. The most significant deviation was the installation of the nozzle onto the Test Assembly at the Test Cell. Scheduling problems of the RN-6 Nozzle (originally scheduled for NRX-A2) and a re-evaluation of the AGC Stainless Steel Nozzle resulted in using the AGC Nozzle on the NRX-A2 Test Assembly. (auth)

18817 (NTO-R-0025) THREE-DAY REPORT FOR EXPERIMENTAL PLAN I. Initial Criticality and Flow Tests. NRX-A3 Test Series. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 12 Apr 1965. 79p. Dep. NTIS $7.00.

Experimental Plan I (initial tests of the NRX-A3 Test Series) was completed on April 7, 1965. Significant results were achievement of initial criticality, performance of initial power calibration, determination of control drum worth, conduct of gaseous flow tests, conduct of liquid flow tests, evaluation of limiter circuits, and evaluation of a reactivity meter. The tests were successfully completed and the major test objectives achieved. Measured nuclear and hydraulic parameters appear to agree very well with predictions. Performance of limiter circuit and reactivity was as generally anticipated. No operational incidents occurred during the tests. Several system abnormalities occurred, but were not significant enough to delay completion of the Experimental Plan. Only a relatively small amount of the diagnostic instrumentation malfunctioned during the test. Post-test inspection indicates that no major apparent damage occurred to the test article. However, post-test pump inspection indicates that repair may be necessary prior to the full power test. Significant events during the test were: (1) initial criticality achieved at 11:35 a.m. PST, and (2) delayed critical drum bank position with no poison wires was approximately 89°. (auth)

18818 (NTO-R-0026) THREE DAY REPORT FOR EXPERIMENTAL PLAN II. Power Calibration and Control Drum Worths. NRX-A3 Test Series. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 20 Apr 1965. 52p. Dep. NTIS $5.75.

Experimental Plan II was completed on April 14, 1965. Particular requirements of the NRX-A3 Test Specification, WANL-TNR-161, pertaining to nuclear power calibration and control drum worth measurements were satisfied. Significant operations included: the activation of calibration devices, the determination of the differential and integral worth of a single control drum over the range of 0 to 180°, the determination of the differential drum worth for each control drum, and the determination of the integral worth of each drum by use of the Reactivity Meter. The tests were successfully completed and the major test objectives achieved. No operational incidents occurred, and no system abnormalities were noted. Control drum worths were about ten percent less than those determined during Experimental Plan-I and, since this apparent discrepancy has not been resolved, investigation is continuing. Determination of control drum worths utilizing the Reactivity Meter were in good agreement with the drum worths determined from doubling times. All control drums have essentially identical worths. (auth)

18819 (NTO-R-0027) THREE DAY REPORT FOR EXPERIMENTAL PLAN III. Neutronic Calibration, Phase II, Flow Test, and Scaled Down Power Tests. NRX-A3 Test Series. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 26 Apr 1965. 54p. Dep. NTIS $5.75.

Experimental Plan III of the NRX-A3 Test Series was completed on April 21, 1965. Particular requirements of the NRX-A3 Test Specification, WANL-TNR-161, as pertains to nuclear power calibration, activation of dosimetry, and scaled-down power tests were satisfied. Significant operations of the Experimental Plan included: checkout of the refurbished TCA turbo-pump, performance of two liquid hydrogen startup profiles through the Test Assembly, setting of the front (low power) and back (high power) neutronic ram positions, activation of the lower power dosimetry, and performance of the scaled-down power profile. The tests were successfully completed and the major objectives achieved. No significant operational incidents occurred, and no system abnormalities were noted. The refurbished turbo-pump operated at the NRX-A3 design points with performance as predicted. (auth)

18820 (NTO-R-0169) XE-PRIME EP-111 INTERMEDIATE POWER DEMONSTRATION TEST AND RESTART. SPEAR Report. (NERVA Test Operations, Jackass Flats, Nev. (USA)). Apr 1969. 580p. Dep. NTIS $32.00.

EP-III of the XE-Prime test series was conducted on 17 April 1969. The objectives were: to demonstrate satisfactory startup to intermediate power, followed by programmed control using the state-programmed temperature control loop; to verify neutronics system calibration at intermediate power; to obtain steady-state engine data, transfer function measurements, and duct data at intermediate power levels; to demonstrate satisfactory engine operation with run tank topping; to demonstrate satisfactory operation during an emergency flow shutdown; to demonstrate satisfactory engine restart with nuclear autostart to temperature loop closure from cooldown conditions; and to demonstrate satisfactory operation during normal shutdown and LH_2 pulse cooldown. Two runs were made and the objectives were met, with the exception of the last one, which was precluded by the programmed power scram. Numerous specific results are discussed in 39 SPEAR memos included. (auth)

18821 (NTO-R-0171) XE-PRIME EP-5C FULL POWER TEST. SPEAR Report. (NERVA Test Operations, Jackass Flats, Nev. (USA)). Jun 1969. 460p. Dep. NTIS $26.00.

Run EP-5C of the XE-Prime test series was successfully conducted on 11 June 1969. The objectives were: to demonstrate satisfactory startup to rated conditions; to demonstrate that the engine, ETS-1, and the NES will operate at rated engine conditions; to obtain additional transfer function measurements; to demonstrate run tank topping at rated engine conditions; and to demonstrate "normal shutdown" and LH_2 pulse cooldown. The test consisted of a nuclear autostart, pressure and temperature loop closure and a programmed ramp along the normal operating line at 50°R/sec. Hold points were established at 2400°R and 3100°R, 3650°R, 3800°R, and full power. The test was concluded with shutdown along the normal operating line with normal cooldown followed by LH_2 pulse cooling. The test objectives were met. Specific results are covered in 37 SPEAR memos included. Several recommendations are made. (auth)

18822 (RN-71001C(Vol.1)) A71C TO APPENDIX B, STATEMENT OF WORK. Volume I. (Aerojet-General Corp., Sacramento, Calif. (USA)). 22 Jan 1971. 196p. Dep. NTIS $13.00.

The NERVA program work projects to be carried out between October 1, 1970 and June 30, 1971 are described in detail. The work is to be carried out in compliance with 12 documents which are listed. Certain agreements related to partial completion, effects of actions or inaction by others, etc. are mentioned. (LTN)

18823 (RN-DR-0078) NRX/EST LEAK MEASUREMENT SYSTEM PERFORMANCE ANALYSIS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1966. 36p. Dep. NTIS $5.00.

A leak measurement system was designed and fabricated to indirectly measure the rate of gaseous hydrogen leakage past the forward flange seal on the NRX test vehicles by measuring the leakage of gaseous hydrogen into a closed known volume. The system was first used on the NRX-A3 engine and modified for use during the NRX/EST tests. Although leakages did occur during the NRX-A3 test series, the failure of a burst diaphragm assembly in the leak measurement system during the first power run partially invalidated the test data and only crude estimates could be made concerning the leakage rates. The leak measurement systems performed within the design limits during the NRX/EST test series and leakages were observed from the forward flange seal during Experimental Plans (EP's) IIB, IIC, III, IV, and IVA. Several data anomalies were reported; however, none of them affected the validity of the test data. (auth)

18824 (RN-DR-0129) MECHANICAL SHOCK TEST, TURBINE POWER CONTROL VALVE ACTUATOR. Suttkus, H. O. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1967. 27p. Dep. NTIS $4.50.

A Turbine Power Control Valve Actuator, Bendix Model NT-D1, was subjected to a mechanical shock test to determine the effect of shock accelerations on the performance of the actuator. Comparison of pretest and posttest performance data indicated that the shock test had no detectable effect on actuator performance. (auth)

18825 (RN-DR-0165) NOZZLE-COOLANT-CHANNEL END-CAP EVALUATION. Final Test Report. Wright, R. B. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1969. 79p. Dep. NTIS $7.00.

Test results on the effectiveness of nozzle-coolant-channel end caps with respect to pressure drop and flow stagnation are documented. Plastic-model end caps (with water flow) were used to determine their effect on pressure loss at the nozzle inlet and outlet and to compare the pressure drops and flow patterns of special end caps with those for a flat end cap of the type used on NERVA technology nozzles. Because visual observations of air bubbles and high-speed motion pictures did not show the flow pattern well enough to demonstrate adequate cooling of the tube end, a second series of tests was performed to demonstrate the relative cooling ability of the reduced-pressure-drop end caps. The results of heat-transfer tests made with full-scale metal end caps brazed into actual NERVA-type U-tubes are described. The tubes were heated with either hot nitrogen or quartz lamps, and the rate of tube-surface cooldown with cold nitrogen flowing was monitored with thermocouples and liquid crystal. (auth)

18826 (RN-DR-702) SPEAR TEAM REPORT, XECF EP-2. (Aerojet-General Corp., Sacramento, Calif. (USA)). 11 Apr 1968. 278p. Dep. NTIS $17.00.

The SPEAR team analysed tests on XECF EP-II conducted on 11 April 1968. This was the second EP with an engine in ETS-1 and was intended to re-run the wet and dry pump bootstrap tests planned for EP-1, conduct flow insertion tests, obtain additional facility operating experience and train a second operating crew. A major portion of the objectives were successfully completed. The XECF engine was smoothly bootstrapped with both a wet and dry pump, at a 35 psia tank pressure. The operating time to conduct the test was reduced about 50% from EP-I and consumption of critical gases was reduced with improved procedures. The LN_2 system, which was not used in EP-I, was activated and a successful switching from GHe to LN_2 in the cooldown line was accomplished. Two of the three planned LH_2 insertion tests were conducted but the desired results were not obtained because of insufficient chilling in the liquid hydrogen transfer line. (auth)

18827 (RN-S-0005) NRX SUPPORT EQUIPMENT. October 1963 Status Report (Issue No. 2). (Aerojet-General Corp., Sacramento, Calif. (USA)). 12 Nov 1963. 56p. Dep. NTIS $6.00.

18828 (RN-S-0008(Suppl.)) DETAIL COST DATA. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jan 1964. 10p. Dep. NTIS $4.00.

This preliminary budget estimate for the Radioactive Waste Disposal Facility High Activity Parts Storage Area, Spent Fuel Storage Facility, and railroad system modifications is based upon the conceptual design and design criteria. The estimate reflects NRDS labor, materials and equipment costs as of January 1964. (auth)

18829 (RN-S-0018) NES ETS-1 DUCT PRELIMINARY DESIGN PRESENTATION. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1963. 31p. Dep. NTIS $4.75.

Preliminary design information for the duct of the nuclear exhaust system of ETS-1 is given. It is based on stress analyses with the estimated mechanical and thermal loadings. (LTN)

18830 (RN-S-0046) SUB-SCALE THERMAL CYCLE TEST PROGRAM. NERVA Exhaust System (SST-2) for ETS-1 Duct. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1964. 252p. Dep. NTIS $15.75.

The function of the NES exhaust duct, ETS-1, is to conduct the engine exhaust gases away from the immediate test area and deposit them where combustion may occur safely. Because of high heat fluxes associated with the exhaust gases, a cooled structure was designed capable of withstanding the mechanical and thermal stresses induced into the coolant channels by the engine exhaust. A detailed structural analysis of the coolant channels, both circular and rectangular, indicated that an elasto-plastic condition would exist in the structure when subjected to the maximum operating condition. The complexity of strain development within the duct structure made it mandatory that an adequate thermal test be conducted in order to verify analytical calculations. The tests attempted to subject the cooled specimens to heat fluxes which generate thermal stresses, with resultant plastic strains equivalent to the conditions experienced under actual operation. The fabrication techniques for the sub-scale test ducts followed the design criteria for the prototype. Fire tests were made on the uncooled ducts at 200 and at 230 psia, the maximum allowed for the Delta engine, but thermal gradients calculated to apply to the walls of the sub-scale cooled ducts were below the requirements. Consequently, only partial achievement of the test objectives could be met relative to the establishment of the maximum cyclical life of the cooled duct. However, thermal gradients analytically determined indicated that thermal strain exceeding the "yield point" strain value by 300% would be induced in the hot wall, resulting in a high elasto-plastic strain state. Six fire tests were made on the rectangular channel specimen and five fire tests were made with the circular channel specimen. No detrimental effects were noted on the structure. The restraint provided by the outer cooled structure was adequate to contain the buckling of the inner hot wall. These results substantially verify the analytical procedures utilized in predicting the thermal strain response of the NES duct structure. (auth)

18831 (RN-S-0096) MINUTES OF THE SECOND QUARTERLY NERVA INSTRUMENTATION MEETING. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1964. 188p. Dep. NTIS $12.50.

The status of instrumentation, measuring instruments, cables, etc. for the NERVA program is given, as presented at the Design Review meeting of April, 1964. (LTN)

18832 (RN-S-0101) PERFORMANCE CHARACTERISTICS OF ETS-1 ALTITUDE NUCLEAR EXHAUST SYSTEM. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1964. 15p. Dep. NTIS $4.00.

In order to evaluate the feasibility of uprating the Nuclear Exhaust System Engine Test Stand No. 1 to full altitude-simulation capability using steam as the secondary ejector fluid, tests were conducted on $\frac{1}{8}$ scale models. The results have been analyzed, the design implications drawn and the expected performance envelope of the selected full size system is presented. (LTN)

18833 (RN-S-0118) TURBINE POWER CONTROL VALVE DEVELOPMENT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1964. 24p. Dep. NTIS $4.25.

Turbine Power Control Valve(TPCV) development activities conducted under the NERVA program during CY 1964 were: design modification of the four-inch TPCV to incorporate a valve shaft thrust bearing; proof and leak testing of the TPCV assembly; fabrication of a bearing tester for use in simulating load and temperature conditions encountered by the bearings during valve operation; hot gas testing of the TPCV to evaluate the design integrity and to demonstrate the valve endurance capability with valve modifications as required; bearing evaluation and endurance tests; fabrication of four TPCV assemblies; and updated test plan and test request for hot gas testing of the Turbine Power Control Valve in C-7 and H-4 test facilities. A detailed discussion of each summary item is given. (auth)

18834 (RN-S-0151) NRX-A PRESSURE VESSEL METALLIC SEAL TEST SERIES II EVALUATION REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1964. 35p. Dep. NTIS $4.75.

Series II NERVA pressure vessel metallic seals tests were conducted during February 1964. The test was performed to evaluate one seal configuration designed and fabricated by ACF Industries, Albuquerque, New Mexico. The seals tested were of two different diameters, closure-end and nozzle-end of the NRX-A aluminum pressure vessel. The seals were evaluated by pressurizing with gaseous helium to a maximum of 645 psig. The maximum leakage rates recorded for the six seals tested ranged from 0.137 to greater than 125 cm^3/s. Based on results obtained from this test series, the ACFI pressure vessel seal configuration will not be utilized in NRX-A test assemblies. The design requirement for leakage to be less than 1×10^{-2} cm^3/s/in. of diameter should be re-evaluated. (auth)

18835 (RN-S-0158) PRESSURE VESSEL-NOZZLE-SEAL ASSEMBLY CONFIRMATION TEST 1070N. Evaluation Report. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1965. 255p. Dep. NTIS $15.75.

The Pressure Vessel-Nozzle-Seal Assembly Confirmation Test was conducted from 12 May to 24 July 1964. The test utilized two candidate NRX nozzles (AGC steel nozzle S/N 008 and the Rocketdyne RN-6 stub nozzle) with the NRX 6061-T6 aluminum pressure vessel, S/N 005. Test objectives were: (1) to evaluate the pressure vessel and nozzle compatibility at an ambient pressure vessel proof pressure of 740 psig, and a nozzle chamber pressure of 560 psig; (2) to measure deflections and rotations of the aft pressure vessel and nozzle flanges; (3) to record strains at critical areas and (4) to evaluate AGC Mod II aluminum seal integrity at the pressure vessel-nozzle joint. The pressure vessel-nozzle compatibility at ambient proof pressure was proven by the insignificant pressure vessel-nozzle joint gaping experienced for both nozzles. Also, the resulting stresses in the nozzles and aft pressure vessel cylinder carried adequate positive margins proving the structural adequacy of the assemblies. (auth)

18836 (RN-S-0190) OPERATIONAL SUPPORT PLAN XE-1 ENGINE. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1966. 203p. Dep. NTIS $13.25.

The basic requirements of the XE-1 Engine Test program are presented and the Ground Support System which satisfies these requirements defined. The planning is predicated on XE-1 Program Requirements as defined on 14 June 1966. (auth)

18837 (RN-S-0190(Vol.1)) OPERATIONAL SUPPORT PLAN XE-1. Volume I. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1968. 237p. Dep. NTIS $15.00.

The XE-1 Operational Support Plan presents the basic requirements of the XE-1 Engine Test Program and defines in detail the Ground Support System which satisfies these requirements. (auth)

18838 (RN-S-0194) RADIATION EFFECTS PROGRAM PLANNING DETAILS FOR GENERAL DYNAMICS, FORT WORTH FOR CONTRACT YEAR 1965. (Aerojet-General Corp., Azusa, Calif. (USA)). Dec 1964. 18p. Dep. NTIS $4.00.

18839 (RN-S-0204(Suppl.2)) PERFORMANCE TEST REPORT AND OPERATION MANUAL ON CFDTS SEQUENCER. Supplement II. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1965. 21p. Dep. NTIS $4.25.

Modifications to provide additional sequencer functions in the Cold Flow Development Test System (CFDTS) are described. (auth)

18840 (RN-S-0205) UPPER THRUST STRUCTURE S/N 0000001, STATIC STRUCTURAL TEST EVALUATION. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. 45p. Dep. NTIS $5.25.

A static structural test was conducted on the NERVA E-Engine Upper Thrust Structure S/N 0000001 at Aerojet-General. The major test results and data evaluation are presented for 12 loading conditions which simulated boost and operating loads to which the structure would be subjected during flight or ground testing. The structure showed more than adequacy capacity to withstand these loads. (auth)

18841 (RN-S-0208(Vol.1)) DATA ANALYSIS REPORT OF NRX-A2 TESTS. Volume I. Bradfute, J. O.; Carroll, J. J.; Kasahara, M.; Licari, J. A.; Sane, J. O.; Sebek, E. J.; Slonim, N. H.; Uffer, R. A.; Westmore, W. R.; Wilgus, C. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1965. 200p. Dep. NTIS $13.00.

Analyses of NRX-A2 test data were conducted to examine the reactor system's performance characteristics and to demonstrate prediction capabilities of engine transient computer programs. Several aspects of the reactor system's performance characteristics were examined as follows: NRX-A2 power levels, flow asymmetry and two phase flow, dynamic analysis of FM/FM recorded data, data error analysis, evaluation of instrumentation reliability, reliability of reflector outlet plenum temperature measurements, nozzle heat transfer conditions, effect of change in nozzle coolant passage size due to dimensional tolerance and thermal expansion, metal surface temperatures, and chilldown conditions. The transient computer programs reliably predicted performance of the NRX-A systems. The basis for the computer analyses is presented and described in detail. (auth)

18842 (RN-S-0212) SYSTEMS ANALYSIS PROCEDURES AND TECHNIQUES. Buden, D. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. 45p. Dep. NTIS $5.25.

The Systems Analysis function of the Systems Analysis and Control Division, REON, is to insure the proper integration of the various engine components and assist in defining component criteria. In order to perform the functional responsibilities, analytical models that describe the various NERVA systems are developed. These are used to investigate the static and transient performance of the engines and the necessary test facilities. From these analytical investigations, component performance in the system is evaluated and the various interactions between components are studied. In addition, operational support is provided for each test system. The functional responsibilities are implemented on a staff level to other participants of the NERVA program such as project engineering, component development, staff engineering, engineering support, safety division, Nevada Test Operation and WANL. A variety of program studies are described. (auth)

18843 (RN-S-0213) CFDTS PRE-TEST PREDICTIONS. Volume II. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. 29p. Dep. NTIS $4.50.

The best estimate of the performance of the hardware components used in the Cold Flow Development Test System (CFDTS) at the time of the Pretest Predictions calculations made in March 1965 is given. Where possible, the actual component hardware test acceptance data were used. The data are not necessarily representative of the components being delivered for the NRX/EST or the X-Engines and should be extrapolated to other systems. The data were used by systems analysis in the current studies of the CFDTS system only and will be upgraded as new information is obtained. (auth)

18844 (RN-S-0213(Vol. 1)) CFDTS PRE-TEST PREDICTIONS. Volume I. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. 55p. Dep. NTIS $5.75.

The CFDTS Pretest Analysis provides analytical predictions of the Cold Flow Development Test System (CFDTS) performance for use in planning the test program and the interpretation of test data. These predictions provide the most current information prior to the actual tests, and form the guidelines for final CFDTS test planning. The agreement between pretest predictions and the actual test results cannot be expected to be better than the data used in the analysis. Large variations in the apparent performance of the turbopump have resulted from small variations in turbopump test measurements. Therefore, the uncertainty in the test predictions is high but is representative of the best data available at the time the calculations were performed. (auth)

18845 (RN-S-0216) LOWER THRUST STRUCTURE S/N 0000001 STATIC STRUCTURAL TEST EVALUATION REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. 47p. Dep. NTIS $5.50.

A static structural test was conducted on the NERVA E-Engine Lower Thrust Structure (S/N 0000001). The major results and data evaluation are presented for 12 loading conditions, which simulated boost and operating loads to which the structure would be subjected during flight or ground testing. The structure showed more than adequate capacity to withstand these loads, but certain design and fabrication changes are suggested which should enable the structure to withstand loads 10 to 20 percent above those imposed. (auth)

18846 (RN-S-0225) NES DUCT INSTRUMENTATION INSTALLATION PROCEDURES. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1966. 45p. Dep. NTIS $5.25.

The procedures to be followed in receiving and installing instrumentation components for use on the NES Duct are described. Both temporary and permanent instrumentation components are covered; further the temporary components include those to be removed after the design demonstration test and those to be left installed but electrically disconnected after the design demonstration test. (auth)

18847 (RN-S-0226) NES DUCT INSTRUMENTATION CHECKOUT PROCEDURE. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1966. 32p. Dep. NTIS $4.75.

The end-to-end functional test of instrumentation components used on the NES Duct is defined. Both temporary and permanent instrumentation components are to be tested in accordance with this document. Additional information is required for some temporary transducers which are to be removed after the design demonstration test. Each transducer, except thermocouples and piezoelectric accelerometers, will be shunt-calibrated to establish base line data. Each transducer, except pressure transducers, will be excited and stimulated as an operational check. Pressure transducers will be excited and stimulated only if the shunt-calibration values vary from those values obtained during laboratory calibration. (auth)

18848 (RN-S-0228) TEST RESULTS, GE TPCV ACTUATORS, SERIES AG-21. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1965. 220p. Dep. NTIS $14.00.

Test results of a candidate Turbine Power Control Valve Actuator are presented. Based on 100 hours of performance testing, including exposure to temperature changes and vibration, it is recommended that the item not be considered for NERVA application on account of sensitivity to environmental changes and shifts in operating characteristics. (LTN)

18849 (RN-S-0232(Rev.3)) NRX/EST TEST PREDICTION REPORT. Revision 3. (Aerojet-General Corp., Sacramento, Calif. (USA)). 6 Dec 1965. 47p. Dep. NTIS $5.25.

The effects of differences in the Cold Flow Development Test System (CFDTS) and the NRX/EST flow configurations are discussed on the basis of particular CFDTS run results and computer calculations of NRX/EST performance. Some predictions are not in good agreement with the test results, particularly with respect to turbopump speed and performance, but as noted the systems are not exactly the same. (LTW)

18850 (RN-S-0232(Rev.5)) NRX/EST TEST PREDICTION REPORT. Revision 5. (Aerojet-General Corp., Sacramento, Calif. (USA)). 28 Feb 1966. 17p. Dep. NTIS $4.00.

Plans for NRX/EST performance testing are presented along with predicted parameters. The test involves (1) a demonstration of the ability to bootstrap from tank pressure to full power and (2) extensive mappings at high temperature from which engine systems performance can be evaluated. (LTW)

18851 (RN-S-0232(Rev.6)) NRX/EST TEST PREDICTION REPORT. Revision 6. (Aerojet-General Corp., Sacramento, Calif. (USA)). 14 Mar 1966. 57p. Dep. NTIS $6.00.

The objectives of this NRX/EST test are to demonstrate the ability of a NERVA-type engine system to bootstrap from a tank pressure of 45 PSIA to full power, to study the stability of the control systems, to obtain high power mapping data and to demonstrate the stability of the core at high power. System response measurements will be conducted at both low and high power points to study the control systems. The operation of the engine at 4000°R chamber temperature will be mapped from design pressure down to the pressure at which the tie rod temperature limit is reached. The expected engine performance and system responses are predicted. (auth)

18852 (RN-S-0250) CFDTS DATA ANALYSIS CY 1965 YEAR END REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jan 1966. 68p. Dep. NTIS $6.50.

The function of the Cold Flow Development Test System (CFDTS) program is to provide experimental information on transient startup characteristics of the NRX/EXT and XE NERVA engine systems during the chilldown period of engine bootstrap. Using this information, the proper startup procedures and safe operating regimes are to be established. Analyses of data from the first series of experiments were conducted to examine chilldown and startup characteristics of the system. This series, involving six individual tests, demonstrated the bootstrap ability of the NERVA Engine system under conditions of 50, 60, 70, and 90 psia tank pressure with 14 psia back pressure to the nozzle and turbine. The data analyses presented concentrated on obtaining information which would aid in upgrading and improving prediction capabilities. (auth)

18853 (RN-S-0256) CFDTS PERFORMANCE ANALYSIS YEAR END REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jan 1966. 233p. Dep. NTIS $14.75.

The function of the Cold Flow Development Test System (CFDTS) program was to provide chilldown and startup information for the NERVA hot bleed engine system. Based upon the best available system performance data, predictions were made for the Block I tests. The results from the Block I tests were carefully studied to determine the system performance. Pressure drops, flow rates, temperatures and turbopump operation were examined for any signs of unusual performance. Based upon this new information, predictions were made for the Block II tests. A theoretical analysis, to predict the flow oscillations during chilldown of the cryogenic fluid transfer lines in the CFDTS, was carried out using one-dimensional flow equations. (auth)

18854 (RN-S-0286) NES DESIGN DEMONSTRATION TEST PLAN WITH TEMPORARY ENGINE COMPARTMENT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1966. 52p. Dep. NTIS $5.75.

The purpose of the Nuclear Exhaust System (NES) is to direct the hot exhaust gases and fission products away from the test stand during a NERVA engine firing, and also to provide a steam safety purge. Because of these requirements, it is necessary that a high confidence level in NES performance be attained prior to utilizing it in a full scale NERVA engine firing. To meet these requirements, the prototype NES will be installed and cold-flow tested for performance at both NERVA design and off-design conditions. If the Permanent Engine Compartment is not completed in time for use during the NES testing, this alternate program provides for a minimum amount of testing and then uses the Permanent Engine Compartment to complete the demonstration of satisfactory operation of the NES Engine Compartment System. A Temporary Engine Compartment and test device (simulated engine and turbine exhaust nozzles) will be supplied and the tests conducted at NRDS using the ETS-1 facility. (auth)

18855 (RN-S-0321) SUMMARY DESIGN REPORT FOR NRX/EST ENGINE CONTROL SYSTEM. Openshaw, F. L. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1966. 86p. Dep. NTIS $7.50.

Design details of the NRX/EST engine control system are described. Methods of control involved the use of two basic engine parameters: thrust-chamber pressure and thrust-chamber temperature, which were selected because of the long-range NERVA-program goals of controlling thrust (pressure) and controlling and maximizing specific impulse (temperature). Control of these basic parameters also ensures that system operation is maintained within constraints imposed by the hardware. (auth)

18856 (RN-S-0323) PERFORMANCE ANALYSIS OF CFDTS AND NRX/EST AS RELATED TO THE X-ENGINE. Ramsthaler, J. H.; Wells, R. A.; Strucel, G. G. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1966. 95p. Dep. NTIS $7.75.

Progress of analytical studies to define the parameters controlling initial startup bootstrap of the NERVA experimental engine is described. Data obtained from the CFDTS series and from the NRX/EST series have been used to improve calculations, especially with respect to low speed turbopump performance. The phenomena occurring during bootstrap, though complex and interrelated, basically involve the transfer of heat from the engine to the hydrogen, the engine flow resistance, and driving force feeding the engine. The driving force is obtained from both tank pressure and feedback from the turbopump. The results observed during engine bootstraps have been analyzed, and the key factors controlling the engine startup defined. The complexity of the phenomena has made it necessary to compute the heat transfer and flow through each of the major engine components and the feedback of energy through the hot-bleed port and turbopump system. A major effort has been to ensure that each engine component is accurately modeled since an erroneous performance by any one component can drastically affect the overall system predictions because of the feedback loop incorporated in the engine. The studies have been limited to startups made with the turbopump in the chilled condition. The analysis of turbopump performance during oscillating two-phase operation is beyond the present capability of the NERVA Digital Engine System Code. The results represent the current status of the startup analysis. A continuing effort is made to improve the analysis, and work has been initiated to include dry-pump startup calculations. (auth)

18857 (RN-S-0329) X-ENGINE DATA ANALYSIS YEAR-END STATUS REPORT. Altseimer, J. H.; Williams, R. J.; Benenson, H.; Kasahara, M.; Slonim, N. H. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 62p. Dep. NTIS $6.25.

The objectives of the X-Engine test plan are briefly reviewed and the data analysis efforts required before and after testing are outlined. A schedule of the data analysis tasks and report requirements for the X-Engine is presented together with a flow chart illustrating how these tasks support overall program activities. Prior to the start of engine testing, major emphasis of data analysis will be on improvements in routine data handling procedures and computerized analysis techniques to provide better quality of useful data within three days following a test. In addition, the data analysis procedures and techniques that will be followed for application of test data to evaluate the performance of advanced engine designs is presented. (auth)

18858 (RN-S-0330) NRX-A5 POST TEST INSTRUMENTATION REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jan 1967. 52p. Dep. NTIS $5.75.

Measurements were made of NRX-A5 temperature, pressure, strain, and vibration parameters. In 57 tests, 48 were completely successful and provided valid data throughout all experimental plans (EP's) within the component design limits and predicted measurement accuracies. Because of intermittent instrument operation during portions of the series, nine measurements were classified as partially successful, although the data were valid during other runs. No measurements were complete failures. Investigation of the causes of intermittent instrument operation revealed characteristics of the engine operating environment and of instrument design not previously known or inaccurately predicted. The faulty operation of most of the instruments affected was attributed to environmental conditions or to unsatisfactory installation. Information obtained from a review of test data and from an investigation into the causes of intermittent operation has been used to redesign the instruments affected or to modify installation requirements to prevent future repetition of this condition. (auth)

18859 (RN-S-0332) YEAR-END REPORT ON DIGITAL-PROGRAM DEVELOPMENT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1966. 119p. Dep. NTIS $9.00.

The development status of the digital-computer programs being used for NERVA systems analysis is summarized. Fifteen such programs are discussed, each of which has a specific purpose and is actively used for NERVA analysis. The principal program is a transient calculation that can predict engine start-ups, power ramps, and power holds. Supporting this program is a steady-state program for quickly calculating power holds, as well as a family of component programs for detailed studies. The component programs are essentially subroutines of the larger programs, with the capability of separate input. These programs are used to study special component tests and to improve analytical techniques. New equations or routines developed from these studies can be used as input to the larger programs. In addition to the principal programs, various special programs have been developed to resolve specific NERVA problems. The system programs, for reasons of economy and computer capacity, must make simplifying assumptions in many of the analytical approaches. The special programs can perform more comprehensive analyses on specific problems but require a greater expenditure of time and money. (auth)

18860 (RN-S-0334) PRESSURE DROP IN A SINGLE U-TUBE TEST SECTION. Geery, E. L.; Thompson, W. R. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jan 1967. 66p. Dep. NTIS $6.50.

An experimental pressure drop study of a single Technology Engine U-tube test section was conducted. The static pressure profile was determined along the modelled nozzle flow passage while flowing cryogenic hydrogen without heat addition, and gaseous hydrogen both with and without asymmetric heat addition. Those tests with heat addition were conducted by resistance-heating a copper cladding on the crown of the stainless steel test section. Defects in the cladding resulted in two test section burnouts; after the second repair the program was restricted to adiabatic flow tests with liquid hydrogen. Experimental profiles were compared with those generated analytically in an attempt to better define the factors controlling pressure drop, with the ultimate objective of upgrading current computational procedures. Although the experimental static pressure profiles were not reproduced analytically, the test results indicate that pressure loss prediction can be improved by considering tube curvature and local surface roughnesses of both the tube and jacket. (auth)

18861 (RN-S-0335) STEADY STATE THERMAL ANALYSIS OF NRX-A6 PRESSURE VESSEL. Vick, O. D.; Westmore, W. R. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1966. 19p. Dep. NTIS $4.00.

Full power nuclear steady state thermal profiles of the NRX-A6 pressure vessel, resulting from nuclear heating and hydrogen cooling, were generated. Profiles were calculated for the pressure vessel cylinder, closure bolts, pressure vessel closure, and closure ports, using Computer Program 278B with the IBM 7094 digital computer. (auth)

18862 (RN-S-0336) STRUCTURAL ANALYSIS OF NRX-A6 PRESSURE VESSEL COMPONENTS AND ASSEMBLY. de la Garza, W.; Nevenzel, J. (Aerojet-General Corp., Sacramento, Calif. (USA)). Mar 1967. 67. Dep. NTIS $6.50.

A stress and deformation analysis of the structural components of the NRX-A6 pressure vessel assembly is presented. The loads and environment are given, followed by the description and analysis of the structure. The results are in the form of stress profiles for the entire vessel for mechanical and thermal loading and stresses in the closure bolts. Margins of safety are summarized and discussed. To fully evaluate pressure vessel components, it was necessary to include the nozzle in the analytical model so a detailed nozzle analysis is also included. The analysis considers only the nuclear steady-state firing condition. Proof hydrotest conditions are not presented since loadings and the basic structural components are identical with those of the XE-1 pressure vessel reported previously. All loads, pressures, and stresses represent nominal operating values. Only in the final margin-of-safety computation are limit loads based on M.E.O.P. considered. This is accomplished by multiplying the net computed stresses, where applicable, by 1.05 to include the assumed ratio for maximum-to-nominal pressure. (auth)

18863 (RN-S-0337) STEADY STATE THERMAL ANALYSIS OF XE-1 PRESSURE VESSEL. Westmore, W. R.; Vick, O. D. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1966. 18p. Dep. NTIS $4.00.

Full-power, nuclear-steady-state, thermal profiles of the XE-1 pressure vessel, resulting from nuclear heating and hydrogen cooling, were generated for use in stress analyses. Profiles were calculated for the pressure vessel cylinder, closure bolts, pressure vessel closure and closure guide tube ports. (auth)

18864 (RN-S-0338) STRUCTURAL ANALYSIS OF THE XE-1 PRESSURE VESSEL COMPONENTS AND ASSEMBLY. Jellison, J. E.; Nevenzel, J. (Aerojet-General Corp., Sacramento, Calif. (USA)). Feb 1967. 86p. Dep. NTIS $7.50.

A structural analysis conducted on components of the XE pressure vessel assembly is described. These components are defined as the forward closure, cylinder, nozzle (including the reactor core-support cylinder), and bolts which connect the forward-closure and nozzle-jacket flanges to those of the cylinder. Analyses indicate all components have positive margins of safety and meet the requirements of the structures design criteria. (auth)

18865 (RN-S-0344) CRYOGENIC TEST PLAN. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1966. 23p. Dep. NTIS $4.25.

Based on analysis and NRX/EST experience, it appears that formation of LN$_2$ in the upper thrust structure is imminent when the GN$_2$ purge gas contacts the surface of lines carrying LH$_2$. These cryogenic tests are designed to investigate the effects of the liquid nitrogen on various components and to evaluate means to prevent the LN$_2$ formation or to provide a method of channeling the LN$_2$ harmlessly overboard. In addition, the tests will provide a checkout of the Upper Thrust Structure (UTS) TV system, a gross leak check of joints under cryogenic condition, and operation of valves. The tests will consist of three parts, the results of each determining to some extent what will be done on the succeeding tests. First, component tests will determine what, if any, deleterious effects the liquid nitrogen has on the electrical and On-Mark connectors. Second, UTS/shield segment tests will determine the extent of LN$_2$ formation and means of preventing this by insulation and/or channeling the liquid overboard. Third, UTSM/Shield Tests will recheck the results of the previous tests, give an indication of any gross leaks in the system and at the UTS/TSA interface, check out certain valves, and verify the operation of the UTS TV system. This test plan indicates the probable sequence of events but will, of necessity, be modified if prior test results indicate a need for deletion or change for any subsequent tests. (auth)

18866 (RN-S-0347) RADIATION EFFECTS PROGRAM PLANS CY 1967. Greenhow, W. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1966. 71p. Dep. NTIS $6.75.

CY 1967 NERVA radiation effects Program Plans are presented and include input from Westinghouse Astronuclear Laboratory, General Dynamics/Fort Worth, and Aerojet-General Corporation. Test schedules for all WANL and Aerojet radiation effects tests, as well as Los Alamos Scientific Laboratory tests at Plum Brook Reactor Facility, are presented. Information regarding test plans, test specifications, experimental plans, hazards analyses reports, test data reports and final test reports are contained herein for all NERVA radiation effects tests scheduled at GD/FW, PBRF, GETR and those experiments scheduled concurrent with NRX tests. In addition to data regarding test activities, information describing the activities at PBRF in support of the cryogenic loop activation as well as the NERVA Radiation Effects Program activities at GD/FW and NRDS is also presented. (auth)

18867 (RN-S-0354) XECF TEST PREDICTIONS. Hampson, L. K.; Sebek, E. J.; Stiger, R. R.; Williams, R. J. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1967. 97p. Dep. NTIS $8.00.

The expected performance of the XECF test assembly is described. Predictions are made and discussed for all tests outlined in RN-S-0314, XECF Test Specification, and in modifications No. 1 and 2 thereof. The test-prediction analysis indicated that, under all test conditions considered, the test-parameter limits would at no time be exceeded; and no unsafe conditions were disclosed that could result in damage to the test article or facility. Descriptions of the engine system, the test facility, and the instrumentation system are included so the report can be used as a comprehensive reference document during quick-look analyses of test results. (auth)

18868 (RN-S-0381) INFLUENCE OF SPACE ENVIRONMENT ON NERVA ENGINE DESIGN. Lamvermeyer, D. J. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1967. 52p. Dep. NTIS $5.75.

The requirements for NERVA versions are that the NERVA engine system will be subjected to operational and space environmental conditions for periods of up to 340 days. This study was made to identify and assess potential problems resulting from extended exposure in space, with special emphasis on vacuum-induced adhesion. The mechanisms of adhesion, sublimation, dissociation, decomposition, fatigue, and heat transfer are discussed relative to materials problems. The influence of NERVA missions on the engine design and reliability is examined. (auth)

18869 (RN-S-0396) SUMMARY OF RADIATION EFFECTS INFORMATION OBTAINED FROM NRX/EST. Hankowsky, J. D. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1967. 62p. Dep. NTIS $6.25.

Radiation effects information obtained from the test of NRX/EST is summarized. Information has been extracted from published reports and is presented as an aid to system designers. The results of component and materials tests performed during the experimental plans or obtained from postmortem examinations are included. It can be concluded that the NRX/EST engine system could operate for at least 30 minutes at design requirements without adverse radiation effects on the test system components. (auth)

18870 (RN-S-0397) SUMMARY OF RADIATION EFFECTS INFORMATION GAINED FROM NRX-A5. Stadig, J. E. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1967. 48p. Dep. NTIS $5.50.

Radiation effects information obtained from NRX-A5 testing are summarized, including information extracted from published reports on component performance, the results of special component tests performed during the experimental plans, and the results of postmortem examinations. (auth)

18871 (RN-S-0409) PROGRAM PLAN FOR CONTRACT YEAR 1967 (MID-YEAR ADJUSTMENT TO "AS-NEGOTIATED" PROGRAM PLAN. NERVA Engine Development Program and Associated Tasks as of 30 June 1967. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 158p. Dep. NTIS $11.00.

The revised overall NERVA program contract work to be performed is described with major project Milestone schedule charts for NRX-A6, XECF, XE-1, XE-2, E-MAD, and ETS-1 and task breakdown of sub-subtasks applicable to CY 1967. (auth)

18872 (RN-S-0412) PRELIMINARY NERVA THRUST VECTOR SYSTEM DEVELOPMENT PLAN. Lucier, J. R.; Thomas, R. W.; Wright, H. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1967. 60p. Dep. NTIS $6.00.

During flight, the NERVA engine will require a means of inducing a turning moment to change course or to reduce to zero the turning moment caused by thrust vector misalignment. The requirements for development of a Thrust Vector System (TVS) are described. The program consists of three areas: (1) design, including analytical effort; (2) development testing; and (3) preliminary and design verification testing. Each area has been divided into phases or type of tests with specific objectives listed to show an orderly and complete program leading to a lightweight, functional, and reliable TVS. Schedules for the development program, fabrication of test components, and testing are also presented. Guidelines constraining these schedules are discussed. (auth)

18873 (RN-S-0423) NUCLEAR ANALYSES IN SUPPORT OF E/STS 2-3 PRELIMINARY DESIGN. Warman, E. A.; Rogers, D. R.; Foreman, D. L.; Whittum, H. O. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1967. 195p. Dep. NTIS $12.75.

Results are presented for nuclear shielding analyses in support of the preliminary design of Engine Stage Test Stands 2 and 3 with emphasis on site layout, facility shielding, test stand design and engine envelope and nuclear ground test module radiation environment (with and without a facility intermediate shield). Generalized data related to materials activation are also included to facilitate analysis in support of further design efforts. Due to the preliminary nature of the facility design, continuing study is required during the iterative process of design evolution. (auth)

18874 (RN-S-0429) TRANSFER FUNCTION ANALYSIS PROGRAM. Benenson, H. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1967. 114p. Dep. NTIS $8.75.

The transfer function program to be used with the X-engine test program is described. A two-phase verification program has been performed and the results indicate excellent correlation with expected values. The first phase of the verification program was to evaluate the analytical transfer function program by using numerical tapes to simulate the equipment transfer function. The second phase consisted of utilizing an analog computer to simulate the expected X-engine transfer function using sine, step, and pseudo-random inputs similar to those in the X-engine test program. In addition, the Aerojet-General processing capability is evaluated. The results of the second phase also showed excellent correlation and provided comparative data relative to the transfer function obtained from the three types of inputs. (auth)

18875 (RN-S-0485) XECF DATA ANALYSIS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1968. 211p. Dep. NTIS $13.75.

The XECF test series demonstrated that the technology engine can be smoothly bootstrapped with a pump that is prechilled prior to initiating engine flow and with a warm pump that is chilled during the initial engine flow through the engine itself prior to bootstrap. Two almost identical bootstraps were obtained by holding the turbine power control valve closed until the reflector inlet temperature reached 50°R. Studies of the data indicated both bootstraps could have been initiated earlier than they were. Critical parameters were identified as the state of pump chill, nozzle chill, tank pressure, and cell pressure. A correlation was developed to predict the proper chilldown point for bootstrap using tank pressure, back pressure, and pump chill condition. Use of this correlation to select a time delay for opening the TPCV may be a desirable startup method. Chilldown of the engine is accurately predicted by a new FORTRAN IV version of the NRO digital computer code for the technology engine. Bootstrap is adequately predicted by the earlier KISMET version of the program, and knowledge gained from these studies is being used in the FORTRAN IV program. When the upgrading is completed, a digital model will be available to accurately predict chilldown, bootstrap, ramp to power, and steady-state holds with the various phases of operation closely matching test data. (auth)

18876 (RN-S-0487) SYSTEM ANALYSIS DIGITAL COMPUTER PROGRAMS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1968. 56p. Dep. NTIS $6.00.

The digital computer programs used by the systems analysis section have undergone continual changes to advance and upgrade their capabilities. The principal improvements made in the various performance analysis programs are indicated. The major portion of the effort has been spent completing the conversion of the Nuclear Engine Transient Analysis Program to FORTRAN IV and adding various desirable new options. In addition, two new programs were developed. The first is a steady-state engine performance program, useful for preliminary studies of new engine configurations. A topping cycle configuration can be modeled on this program as well as the hot-bleed cycle. The second program is a nuclear afterheat-removal analysis program. Calculations simulate the performance of an engine system in space during periods of normal operation followed by cooldown and pulse cooling. The program can follow a typical system over multiple firings and cooldowns during long simulated missions. In the data analysis area, the narrow-band data analysis program was made operational and used successfully to reduce data from a variety of facility tests at the Nevada test site. Numerous improvements were made to the various programs and routines that comprise the wide-band data analysis system. Details of these programs are presented in the technical discussion. (auth)

18877 (RN-S-0495) PREDICTED MEASUREMENT UNCERTAINTIES, XE-P. Kneeland, D. G. (Aerojet-General Corp., Sacramento, Calif. (USA). Nuclear Div.). Dec 1968. 88p. Dep. NTIS $7.50.

Uncertainty values are provided that define the uncertainty band associated with each point in the measurement range for the listed parameters of the XE-P test. Uncertainties attributable to the transducers and those attributable to the data-recording and -reduction system have been evaluated independently and shown separately to demonstrate the relative contributions. The total measurement uncertainty is also indicated and was obtained by assuming that the transducer and data-system uncertainties are random and can be combined through the square-root-of-the-sum-of-the-squares (RSS) technique. Transducer calibration uncertainties are obtained from various sources, including purchase specifications, acceptance-test data, evaluation-test data, and calibration data. In addition to calibration uncertainties, the transducers are affected by environmental changes. Deviations in transducer performance due to the operating environment are included as part of the transducer uncertainty when they are nonpermanent. Permanent deviations in performance (such as might be caused by cumulative radiation effects) are a function of test chronology and cannot be reported until posttest data are available. Nonpermanent uncertainties due to environmental conditions are obtained by analyzing the effects of expected test extremes. Data-acquisition-system uncertainties for the test series are based on the results obtained from the ETS-1 data-acquisition-system tests. (auth)

18878 (RN-S-0499) NERVA ALTITUDE SIMULATION SYSTEM (NASS) MANAGEMENT PLAN. (Aerojet-General Corp., Sacramento, Calif. (USA). Nuclear Div.). Jan 1969. 54p. Dep. NTIS $5.75.

The primary objective of the Nerva Altitudes Simulation System (NASS) program is to develop the data and documentation needed to determine the design. The total NASS has been defined as a subsystem of ETS-1, consisting of: a duct, which includes a diffuser (pumping) section, an elbow section, an ejector (secondary pumping) section, and the necessary mountings and instrumentation; a steam-generation and -delivery subsystem (SGDS), which includes the ejector pumping fluid generator (and accumulator, if necessary) with supporting fuels, pumps, and other necessary items (except water supply, which is supplied from the existing ETS-1 supply); and ancillary subsystems, which include all other supporting elements not currently available within the present capabilities of ETS-1. The scope of work in CY 1969 is the provisioning of manpower, computer capabilities, and test facilities to define the requirements of NASS, define design criteria for the duct and SGDS, and complete the preliminary design of the duct. (auth)

18879 (RN-S-0505) SUMMARY OF THE RADIATION EFFECTS INFORMATION GAINED FROM NRX-A6. Conant, J. W. (Aerojet-General Corp., Sacramento, Calif. (USA). Nuclear Div.). Jul 1969. 28p. Dep. NTIS $4.50.

Radiation effects information obtained from NRX-A6 testing are summarized, including information extracted from published reports and other sources on component performance, the results of special tests performed during the experimental plans, and the results of post-operative examinations. (auth)

18880 (RN-S-0510) XE-PRIME ENGINE FINAL REPORT. Volume III, Book I. Test Data Analysis. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1970. 754p. Dep. NTIS $40.75.

The XE-Prime engine was the first nuclear rocket engine to be tested with components in a flight-type, close-coupled arrangement. The general objective of the test series was to further extend nuclear rocket technology in preparation for a flight system and to operate the test facility under nuclear firing conditions. Volume III, Book 1 of a three-volume series, provides an analysis of test data. The XE-Prime tests involved startup, operation in various modes to demonstrate controllability, shutdown (by three different methods), control of after-heat, and numerous measurements of temperature, fluid flows, dosimetry, etc. and the evaluation of non-nuclear components with respect to reliability, performance, vibrations, transfer functions, etc. With a few exceptions, the results agreed reasonably with the expected performance based on mathematical models which have been developed. However, it is recommended that these models be improved by the use of better flow measurements, better low temperature measurements, better transfer function measurements, more and better dosimetry measurements. In some cases improved operations required certain adjustments or experience with the controls. The XE-Prime test results provide a firm technological basis for concepts that may be applied directly or in improved form to the NERVA engine, including the use of temperature autostart, engine restart, run-tank topping, and pulse cooling. In addition, many of the techniques developed for efficient operation of the test facility, instrumentation, data acquisition, and rapid data reduction will be useful for future engine development. The NERVA engine will be a turbopump-fed engine using hydrogen as the propellant. It will employ a regeneratively-cooled thrust chamber and reflector, and a reactor core and control drums similar to those of XE-Prime. (auth)

18881 (RN-S-0510(Vol.3)Bk2) XE-PRIME ENGINE FINAL REPORT. Volume III, Book 2. Test Data Analysis: Startup Systems. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1970. 485p. Dep. NTIS $27.25.

The XE-Prime engine was the first nuclear rocket engine to be tested with components in a flight-type, close-coupled arrangement. The general objective of the test series was to further extend nuclear rocket technology in preparation for a flight system and to operate the test facility under nuclear firing conditions with special emphasis on reactor start-up procedures and analysis. An analysis of startup systems is presented. (auth)

18882 (RN-S-0528) 75K NERVA ENGINE SYSTEM ANALYSIS S-1 DATA ITEM. (Aerojet-General Corp., Sacramento, Calif. (USA). Nuclear Div.). Sep 1969. 381p. Dep. NTIS $22.25.

The engine model and input for the NETAP program are described in Volume I. The engine performance and operating characteristics were determined for full-power, prestart, ramp-to-full power, and shutdown. Full-power engine-performance values from the NETAP program were then used as input for the FEP program. Values used for P_c and T_c vs time were those for Mission B. Engine burn and coast-time were obtained from trajectory-analysis personnel. Values for thrust and I_{sp} vs time were provided to the trajectory-analysis program so the time and duration of each full-power burn required for Mission B could be computed. The prestart, bootstrap, ramp-to-full-power, and shutdown obtained from the NETAP program were used at the beginning and end of each full-power burn in the FEP program. The thrust and I_{sp} vs time curves for Mission B were obtained from the FEP program. The component state-points were obtained from tapes provided by the NETAP program with a corresponding shift made in the time scale to match the Mission B profile. These values for selected parameters (e.g., flow, pressure, and temperature of the hydrogen entering and exiting a component) are contained in the last section. (auth)

18883 (RN-S-0132) EVALUATION OF NRX-A1 INSTRUMENTATION KIT. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1964. 104p. Dep. NTIS $8.25.

The NRX-A1 test series was conducted at the Nuclear Rocket Development Station during March and April 1964. Test objectives were: to determine the effect of test conditions on the dynamic stability and structural integrity of the NRX-A1 test assembly and its components; and to demonstrate the ability of components and subassemblies to perform adequately. This report presents the evaluation of the NRX-A1 instrumentation. One-hundred seventy-eight transducers were installed to measure NRX-A parameters. Of these, 163 performed satisfactorily while 15 failed. Recoverable transducers were evaluated by comparing pre and post test calibrations. (auth)

18884 (RN-TM-0188) NRX/EST EVALUATION OF ENGINE SYSTEM COMPONENT RADIATION ENVIRONMENT. Garrington, G.; Lindsey, B. A.; Warman, E. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). 7 Jun 1965. 59p. Dep. NTIS $6.00.

Several megawatts of energy escape from the NERVA Nuclear Subsystem in the form of neutron and gamma radiation. Some of this radiation is scattered off the test assembly and test facility into the vicinity of the engine system components. In addition, many of these neutrons are absorbed with an accompanying release of capture gamma radiation. The leakage rate of neutrons from an NRX reactor is sufficiently high to cause substantial sources of secondary gamma radiation in all areas of the test facility and test assembly. Radiation from these sources as well as from scattering are included in the prediction of the environment of the engine components. Results of analyses of the nuclear radiation environment of engine system components for NRX/EST are reported. The various radiation shields are described and nuclear interactions with Test Cell A are reviewed. Models used and analytical methods employed are discussed, including descriptions of all sources which contribute to the radiation environment of the engine system components. Only the full rated power condition of 1120 MW is treated. (auth)

18885 (RN-TM-0207) FAILURE ANALYSIS REPORT. S/N 2H Nozzle. Goodman, S. (Aerojet-General Corp., Sacramento, Calif. (USA)). May 1965. 41p. Dep. NTIS $5.25.

On July 6th, 1964, a 2H nozzle (P/N 296500-9) suffered damage during its tenth chemical firing test and a number of tubes in the throat area (actually 2 areas 180° apart) were cracked. Pressure variations and/or cycling of pressure variations had been sufficient for the combustion stability monitor to end the test. Micrograph studies of the affected areas showed indications of thermal fatigue, grain growth, niobium-carbide solution and niobium carbo-nitride liquation with some evidence of temperatures of the order of 2100 to 2600°F. The material was sound and of the desired thickness initially. Erosion was negligible. It was concluded that flame instability caused severe local overheating. It is recommended that vacuum treated stainless steel Type 347 be used for the U-tube material to prevent the formation of niobium carbo-nitrides and improve stress-rupture strength. (LTN)

18886 (RN-TM-0339) LOWER THRUST STRUCTURE S/N 0000012 STRUCTURAL TEST EVALUATION. Allgair, E. H. (Aerojet-General Corp., Sacramento, Calif. (USA)). 19 Mar 1966. 58p. Dep. NTIS $6.00.

A series of four structural tests were successfully completed on an XE-1 type NERVA lower thrust structure fabricated for the Cold Flow Development Test Stand (CFDTS) Program. The testing consisted of applying axial tension loads to the lower thrust structure while assembled to the CFDTS upper thrust structure and applying axial tension and compression loads and lateral shear loads to the lower thrust structure alone. Based on the strain gage and dial indicator data obtained during the tests it was concluded that the lower thrust structure successfully demonstrated structural integrity for CFDTS load conditions. These tests also supplied significant data applicable to the design of the Lower Thrust Structure for the X-Engine Program. (auth)

18887 (RN-TM-0400) INVESTIGATION OF 5 INCH BUTTERFLY VALVE ACTUATOR CLEVIS FAILURE. Dessau, P. P. (Aerojet-General Corp., Sacramento, Calif. (USA)). Nov 1966. 14p. Dep. NTIS $4.00.

During the 22nd cycle of the demonstration test of a 5 inch butterfly valve assembly, the clevis, P/N 1114805, which connects the valve gate to the actuator piston, failed. Failure occurred at an operating temperature of -200°F. It was apparently caused by a combined tensile and shear load in one clevis lug. The opposite lug failed in shear. The origin of failure was located in a sharp lug to body radius (0.020 radius per drawing) with stress concentrated further by tool marks oriented unfavorably toward the applied loads. It was recommended that the clevis lug radii should be increased to accommodate abnormal assembly, thermal and actuation loads. It is noted that the aluminum alloy, 7075-T73, met the specified chemical analysis and heat treatment and that there was no evidence of fatigue. (auth)

18888 (RN-TM-0409) PRELIMINARY STUDY OF HYBRID COMPUTER TECHNIQUES FOR NERVA-ENGINE DYNAMIC PROBLEMS. Carroll, J. J. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1967. 28p. Dep. NTIS $4.50.

Analog computer simulation now in use for NERVA engine studies can only represent certain system characteristics in limited detail. Equipment availability and storage capacity of the analog restrict the detailed simulation of such three-variable functions as: turbopump performance, hydrogen properties, and two-phase-flow heat transfer. Sectionalized subsystem heat-transfer studies of the engine nozzle, reactor reflector, and reactor core require considerable analog equipment for any amount of detailed analysis. Hybrid simulation of these system characteristics offers considerable advantages when the digital sector of the hybrid is used for storage of function generation and sectionalized space variables. Two of these basic subsystems were studied to explore hybrid computer dynamics and programming methods to evaluate hybrid computer techniques for NERVA applications: (1) simulation of a technology-engine (XE) turbopump performance map and (2) heat-exchanger dynamics for a typical three-section reactor model. Dynamic response tests were performed, and the nature and shape of the output functions were examined. Frequency- and step-response tests of the hybrid-heat-exchanger model were compared with an all analog solution of the same equations. Step changes in available torque and weight flow to the TPA-mapping hybrid simulation were examined for dynamic shape and accuracy of the output performance functions. Hybrid solution of these problems was successfully accomplished, but the results indicate that analog-to-digital sampling rates and digital-computation cycle time must be carefully examined before the response characteristics of a total hybrid simulation can be predicted. (auth)

18889 (WANL-PR(LL)-022(Vol.1)) SYNTHESIS OF CALCULATIONAL METHODS FOR THE DESIGN AND ANALYSIS OF RADIATION SHIELDS FOR NUCLEAR ROCKET SYSTEMS. Volume I. Radiation Measurements in a Nuclear Rocket Propellant Tank Mockup Using Simulated Liquid Hydrogen. Woodsum, H. C.; Rowland, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1968. Contract NAS-8-20414. 201p. Dep. NTIS $13.25.

The measurement and analysis of the radiation environment on and in a modified 72-inch diameter Saturn 1-B LOX tank suspended above a nuclear rocket critical assembly are reported. Measurements were performed at the Westinghouse Astronuclear Experimental Facility (WANEF) with the tank filled with two different densities of polyethylene (0.59 and 0.14 gm/cc) to simulate, respectively, the neutron and photon transport properties in liquid hydrogen. A critical mockup of an NRX (NERVA Reactor Experiment) nuclear reactor provided a source of neutron and gamma radiation with the desired spectral characteristics. Two different shield mockups were interposed between the reactor and the propellant tank. Measurements of neutron fluxes, fast neutron dose rates, and gamma dose rates were made in the propellant tank to provide data on neutron and photon transport properties. Thermal neutron fluxes and neutron spectra on the surface of the tank in a ground test environment were obtained for use in the evaluation of after-shutdown problems associated with activation of the propellant tank structure and for evaluation of radiation analysis methods. Some effects of test cell background were determined experimentally. Comparisons of calculated and measured neutron and gamma radiation levels are included. The two-dimensional discrete ordinates transport code, DOT, was employed to generate neutron fluxes throughout the reactor assembly; and the data processing code, NAGS, generated source data from those neutron fluxes for use in the point kernel and Monte Carlo analyses. Calculations in the propellant tank were performed utilizing the KAP-V point kernel code and the FASTER Monte Carlo code. The experimental portion of the work is presented. (auth)

18890 (WANL-PR(LL)-022(Vol.2)) SYNTHESIS OF CALCULATIONAL METHODS FOR THE DESIGN AND ANALYSIS OF RADIATION SHIELDS FOR NUCLEAR ROCKET SYSTEMS. Volume II. Analysis of Radiation Measurements in a Nuclear Rocket Propellant Tank Mockup Using Simulated Liquid Hydrogen. Stephenson, L. D.; Soltesz, R. G.; Disney, R. K.; Zeigler, S. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1968. Contract NAS-8-20414. 88p. Dep. NTIS $7.50.

The measurement and analysis of the radiation environment on and in a modified 72-inch diameter Saturn 1-B LOX tank suspended above a nuclear rocket critical assembly are reported. Measurements were performed at the Westinghouse Astronuclear Experimental Facility (WANEF) with the tank filled with two different densities of polyethylene (0.59 and 0.14 gm/cc) to simulate, respectively, neutron and photon transport properties in liquid hydrogen. A critical mockup of an NRX (NERVA Reactor Experiment) nuclear reactor provided a source of neutron and gamma radiation with the desired spectral characteristics. Two different shield mockups were interposed between the reactor and the propellant tank. Measurements of neutron fluxes, fast neutron dose rates, and gamma dose rates were made in the propellant tank to provide data on neutron and photon transport properties. Thermal neutron fluxes and neutron spectra on the surface of the tank in a ground test environment were obtained for use in the evaluation of after-shutdown problems associated with activation of the propellant tank structure and for evaluation of radiation analysis methods. Some effects of test cell background were determined experimentally. Comparisons of calculated and measured neutron and gamma radiation levels are included. The two-dimensional discrete ordinates transport code, DOT, was employed to generate neutron fluxes throughout the reactor assembly; and the data processing code, NAGS, generated source data from those neutron fluxes for use in the point kernel and Monte Carlo analyses. Calculations in the propellant tank were performed utilizing the KAP-V point kernel code and the FASTER Monte Carlo code, both of which were previously provided to MSFC under this contract. Volume 1 described the experimental portion of the work, while Volume 2 presents an analysis of these measurements. An appendix to Volume 2 presents detailed geometrical and material descriptions of the reactor and shield mockups and listings of the computer code data employed in this analysis. (auth)

18891 (WANL-PR(LL)-034(Vol.1)) NUCLEAR ROCKET SHIELDING METHODS, MODIFICATION, UPDATING, AND INPUT DATA PREPARATION. Volume I. Synopsis of Methods and Results of Analysis. Final Progress Report. Soltesz, R. G.; Disney, R. K.; Kaiser, R. S.; Jedruch, J.; Zeigler, S. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. Contract NAS-8-24919. 98p. Dep. NTIS $8.00.

A summary of the shielding analysis methods used and the results of the analyses performed are presented. Included are: use of the MSFC complete code package—a description of the preliminary or parametric and the detailed design method; nuclear shielding methods and master library data—a description of the computer codes and master library files provided; and evaluation and calculations—a presentation of selected results using the code package. (auth)

18892 (WANL-PR(LL)-034(Vol.2)) NUCLEAR ROCKET SHIELDING METHODS, MODIFICATION, UPDATING, AND INPUT DATA PREPARATION. Volume II. Compilation of Neutron and Photon Cross Section Data. Final Progress Report. Soltesz, R. G.; Kaiser, R. S.; Disney, R. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. Contract NAS-8-24919. 134p. Dep. NTIS $9.75.

The compilation of neutron and photon cross section data is described in the following categories: neutron cross sections for the ANISN-W and DOT-IIW discrete ordinates transport codes and their auxiliary codes; photon cross sections for the ANISN-W and DOT-IIW discrete ordinates transport codes, the KAP-VI point kernel code, and the SCAP single- and albedo-scatter code; preparation of multigroup cross section sets (with upscatter removed, if desired), using the WANL modified version of the ANISN code or the APPROPOS cross section preparation code; and basic, nuclear data for nuclear and radiation analysis of a nuclear system. The multigroup cross sections described are applicable for the analysis of graphite-moderated, nuclear reactor, rocket systems. (auth)

18893 (WANL-PR-(LL)-034(Vol.3)) NUCLEAR ROCKET SHIELDING METHODS, MODIFICATION, UPDATING, AND INPUT DATA PREPARATION. Soltesz, R. G.; Disney, R. K.; Zeigler, S. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. Contract NAS-8-24919. 419p. Dep. NTIS $24.00.

A description of the cross section generation and data processing techniques for analyzing nuclear reactor systems is given. These techniques include 1) the GAMLEG-W code for generating multigroup photon cross sections for use in discrete ordinate and Monte Carlo transport codes; 2) the APPROPOS code for preparing multigroup, simultaneous, neutron-photon cross section data and neutron reaction cross section data for radiation transport codes; 3) the NAGS code for processing the output fluxes from one- and two-dimensional discrete ordinate transport codes to provide neutron and gamma ray distributed source data as well as nuclear energy deposition; and 4) the SATURN code for processing master library cross section data including optional, transverse leakage corrections, adjoint reversals, and mixture operations. Detailed user information is supplied for each code. This information includes problem setup, running time, required input data, and tape and core storage requirements. A sample problem card input and printout as well as a description of printed, punched and tape output is included for each code. (auth)

18894 (WANL-PR(LL)-034(Vol.4)) NUCLEAR ROCKET SHIELDING METHODS, MODIFICATION, UPDATING, AND INPUT DATA PREPARATION. Volume IV. One-Dimensional, Discrete Ordinates Transport Technique. Final Progress Report. Soltesz, R. G.; Disney, R. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. NAS-8-24919. 104p. Dep. NTIS $8.25.

The WANL version of the ANISN computer code for solving the one-dimensional, energy dependent, linear Boltzmann transport equation with general anisotropic scattering is described. The major improvements of the ANISN-W code over the ANISN code are the inclusion of automated tape linkage of input and output data, and the capability to input a distributed or shell source from cards and/or tape. Detailed user information including problem setup, running time, boundary conditions, quadrature data, and mesh spacing requirements is described. In addition, requirements for cross section weighting, search calculations, activities, and stacked problems are given. Typical problem setup information is supplied as well as a description of the printed output. A sample problem card input and printout are included. (auth)

18895 (WANL-R-202) WANL R-202 PRESENTATION AT SPACE NUCLEAR PROPULSION OFFICE, CLEVELAND EXTENSION, NASA, JULY 16, 1970. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 14p. Dep. NTIS $4.00.

A brief description of system FMECA is given. It is a new kind of failure and malfunction analysis involving modeling and logic diagrams with the objective of improving the reliability of component systems. It will be applied first to the Structural Support Coolant Assembly (SSCA) and to the Nuclear SubSystem (NSS). (LTN)

18896 (WANL-TME-230(Rev.B)) NRX-A1 BILL OF MATERIALS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Feb 1963. 140p. Dep. NTIS $10.00.

A detailed revised list of materials, components, test facilities and support equipment needed for the NRX-A1 reactor is provided. (LTN)

18897 (WANL-TME-244) AEROJET-GENERAL CORPORATION REPORT NO. 2325. Svasek, A. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Jan 1963. 29p. Dep. NTIS $4.50.

Sections of the second rough draft of an Aerojet-General Corp. report on the requirements for post-operative studies of NERVA reactor components and the capabilities required for such studies were submitted to WANL for review. Suggested modifications are noted. (LTN)

18898 (WANL-TME-267) WANEF OPERATIONS MANUAL. Freidhof, W. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 148p. Dep. NTIS $10.50.

The controls and procedures by which the Westinghouse Astronuclear Experimental Facility (WANEF) will ensure that the performance of the various critical experiments is carried out in a safe and efficient manner are described. (auth)

18899 (WANL-TME-267 (Rev. G)) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY REACTOR OPERATIONS MANUAL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1968. 53p. Dep. NTIS $5.75.

18900 (WANL-TME-267 (Rev. H)) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY REACTOR OPERATIONS MANUAL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1969. 30p. Dep. NTIS $4.50.

18901 (WANL-TME-267 (Rev. I)) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY REACTOR OPERATIONS MANUAL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1970. 57p. Dep. NTIS $6.00.

18902 (WANL-TME-382) RESPONSE TO QUESTIONS AND ACTION ITEMS ARISING FROM CABLING AND HARNESS MEETING AT SNPO-C MAY 28, 1963. Morris, W. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Jun 1963. 3p. Dep. NTIS $4.00

18903 (WANL-TME-401) NRX-A1 SPECIFICATIONS FOR COLD FLOW CORE OBSERVATION. Goldberg, S.; Kutilek, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Jun 1963. 9p. Dep. NTIS $4.00.

Specifications are intended to define the environmental conditions, performance requirements and operational requirements for a (1) high speed cinematographic system; (2) remotely controlled, closed circuit TV system; and (3) object illumination system for cold flow core observations in NRX-A1. These systems will be utilized to provide base line information for (a) vibration analysis; (b) coolant gas flow distribution; and (c) pressure wave propagation in the core. The objects to be viewed will be the cluster supports, tie rod ends and nozzle chamber wall (for reference purposes) of the reactor assembly. (auth)

18904 (WANL-TME-405) NERVA NUCLEAR SUBSYSTEM NRX-A1 BILL OF MATERIALS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Jun 1963. 17p. Dep. NTIS $4.00.

Materials and support equipment requested, fabricated or provided for the NERVA NRX-A1 nuclear subsystem with requirement dates are described. (LTN)

18905 (WANL-TME-413) BERYLLIUM REFLECTOR SPECIMEN THREAD STRENGTH TESTS. Kallin, I. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 May 1963. 31p. (EE-3096). Dep. NTIS $4.75.

Strengths at failure are reported for a number of threaded beryllium specimens loaded in tension at room temperature and −320°F. Loads greater than normal bolt strengths were repeatedly carried. The standard fine thread was somewhat stronger than the standard coarse thread. Material at the entrance of the hole should be counterbored about one diameter deep in order to resist cone-type fracture. Pure tensile loading should be used. Possible shear loading should be carried by separate pins to avoid bending moments, since this effect has not yet been evaluated. Two diameters of thread engagement is sufficient for strength; greater engagement has no advantage. (auth)

18906 (WANL-TME-416(Rev.1)) NERVA SUPPORT EQUIPMENT PROVISIONING LIST AND SCHEDULE FOR NRX-A1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Jul 1963. 79p. Dep. NTIS $7.00.

The support equipment needed for the NRX-A1 reactor test is listed with schedules for design, fabrication or purchase, inspection, etc. (LTN)

18907 (WANL-TME-416(Rev.2)) NERVA SUPPORT EQUIPMENT PROVISIONING LIST AND SCHEDULE FOR NRX-A1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Aug 1963. 80p. Dep. NTIS $7.00.

A detailed list of support equipment needed for the NERVA program is provided with design, procurement or fabrication, inspection, etc. schedules for each item. (LTN)

18908 (WANL-TME-416(Rev.3)) NERVA SUPPORT EQUIPMENT PROVISIONING LIST AND SCHEDULE FOR NRX-A1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Oct 1963. 80p. Dep. NTIS $7.00.

A revised, detailed list of support equipment needed for the NERVA program is provided with design, procurement or fabrication, inspection, etc. schedules for each item. (LTN)

18909 (WANL-TME-416(Rev.5)) NERVA SUPPORT EQUIPMENT PROVISIONING LIST AND SCHEDULE FOR NRX-A1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Feb 1964. 87p. Dep. NTIS $7.50.

The support equipment needed for the NRX-A1 reactor test is listed with schedules for design, fabrication or purchase, inspection, etc. (LTN)

18910 (WANL-TME-416(Rev.7)) NERVA SUPPORT EQUIPMENT PROVISIONING LIST AND SCHEDULE FOR NRX-A1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Mar 1964. 90p. Dep. NTIS $7.50.

The support equipment needed for the NRX-A1 reactor test is described with schedules for design, purchase or fabrication, inspection, etc. (LTN)

18911 (WANL-TME-416(Rev.8)) NERVA SUPPORT EQUIPMENT PROVISIONING LIST AND SCHEDULE FOR NRX-A1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 May 1964. 102p. Dep. NTIS $8.25.

Support equipment needed for the NRX-A1 reactor test is described, with schedules for design, purchase or fabrication, inspection, etc. (LTN)

18912 (WANL-TME-458) DEMONSTRATION SHIPMENT OF A SIMULATED REACTOR BY RAIL. Volume II Data Analysis. Scialdone, J. J.; Appleman, R. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1963. 42p. Dep. NTIS $5.25.

The round-trip demonstration shipment of an instrumented NRX-A reactor from Large, Pennsylvania, to Las Vegas, Nevada, is described. The major goal was to gather data relative to shipping loads. It was shown that transportation environment and maximum acceleration loads are well within the requirements established by the reactor design criteria. (auth)

18913 (WANL-TME-487) WESTINGHOUSE ASTRONUCLEAR WANEF PRE-OPERATIONAL SYSTEMS TESTS. Freidhof, W. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Dec 1963. 66p. Dep. NTIS $6.50.

Pre-operational systems tests performed at the Westinghouse Astronuclear Experimental Facility (WANEF) are described. They were performed to ensure that all systems required for the safe and efficient operation of the facility were installed properly and operate in accordance with the specifications set forth in the system design. (auth)

18914 (WANL-TME-501) DESCRIPTION OF WANL SOURCE TERM PROGRAM. Kraig, H. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 27 Aug 1963. 9p. Dep. NTIS $4.00.

The hazards due to radioactive fuels and fission products reaching the earth's surface after a space reactor flight are considered in a preliminary way. The question of fragmentation by nuclear or chemical explosions to provide better dispersal is considered but no conclusion reached. Computer programs are being developed. (LTN)

18915 (WANL-TME-560) COMPILATION OF CONTRACT YEAR 1964. Preliminary Test Plans of the WANL-Radiation Effects Program. Cadoff, H. Y.; Zorn, J. B.; Freas, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Oct 1963. 69p. Dep. NTIS $6.50.

Radiation tests on materials, components and instruments have been planned to implement the WANL portion of the NERVA program. Plans describing these tests are presented. (auth)

18916 (WANL-TME-593) STANDARD TEST CAR WIRING FOR NRX-A REACTORS. Roller, R. F.; Vuckovich, M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Nov 1963. 20p. Dep. NTIS $4.00.

During the testing of NRX-A reactors, the reactor and pressure vessel are mounted on top of a specially-designed railroad car, used to transport the reactor from the assembly area to the test cell. The test car becomes the resting place of the reactor during testing, and therefore provides termination for all instrumentation and control wiring on or about the reactor itself. This standard test car contains sufficient spare terminals and channels to provide more than enough capability for any foreseen NRX-A test, either cold or hot. Because the car described was a standard item ACF Industries could proceed to construct a test car with very little additional information required. WANL would not be hampered from making last minute changes because of test car wiring, thus leading to better instrumentation as transducers begin to qualify in radiation environments. (auth)

18917 (WANL-TME-619) TORQUEMOTOR CHARACTERISTICS. Hornberger, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Dec 1963. 13p. Dep. NTIS $4.00.

The initial investigation into the properties of the torquemotor-servovalve combination (typical of the types proposed for the 1st Generation Actuator) disclosed some unexpected characteristics. The problem centered in the torquemotor where the relationship of driving voltage to the current flow resulted in excessive lag. The ability to make a given torquemotor respond, therefore, depends on the driving means as well as the parameters of the torquemotor. The driving means used in the 1st Generation Amplifier is discussed and found lacking. A transfer function typical of the torquemotor input conditions is described, and any voltage drive must account for this transfer block as part of the overall transfer function of the torquemotor. The proposal is made that considering all known factors a high impedance current source be used with the loop (through the torquemotor coils) closed on current. If the circuit can be made stable, this method should permit a significant increase over the previous level of performance. (auth)

18918 (WANL-TME-623) LABORATORY REACTOR SIMULATOR. Merchant, C. C.; Welsh, R. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Dec 1963. 19p. Dep. NTIS $4.00.

A laboratory reactor simulator has been designed and built to be used with reactor controller breadboards and prototype controllers. This simulator is used to perform closed loop tests preliminary to testing the breadboard with the reactor simulation on an analog computer. By using the laboratory reactor simulator, trouble shooting, preliminary adjustments, and limited tests can be made on the reactor controller without requiring expensive computer time. While some assumptions were used to simplify the reactor equations used in the development, they do not limit the usefulness of the reactor simulator, but in no way is it intended to replace or eliminate the need for testing breadboard reactor controllers on a good analog model of the reactor and engine. (auth)

18919 (WANL-TME-624) DEVELOPMENT OF A BRAZING PROCESS FOR SEAL BLOCKS. Laughner, E. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Dec 1963. 24p. Dep. NTIS $4.25.

A method of brazing instrumentation leads to seal blocks, which meets all the engineering requirements, has been developed and qualified for application to NRX-A1. 1076 brazed joints, which include qualification, preproduction and production pieces, were made with only 5 failing to meet leak test requirements. A gold plate is superior to a silver or copper plate in that the gold-stainless bond can better withstand the temperature of brazing and because the braze alloys will flow or wet better against a gold plate surface. It is essential to use fluxless brazing methods capable of producing a uniform bond with minimum porosity when brazing the copper inlay into the stainless steel seal blocks. Handling during assembly must be such that no dirt, grease or chips are introduced into the joint since very little cleaning can be accomplished after threading the seal block over the instrumentation tubes. (auth)

18920 (WANL-TME-625) EVALUATION OF AN ELECTRON BEAM WELDING PROCESS FOR CONTROL DRUMS. Stemann, L. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Dec 1963. 23p. Dep. NTIS $4.25.

A welding technique has been developed for the production of control drum assemblies. These parts required the joining of end caps to tubes with a minimum of distortion, weld build-up and heat input. Hi-voltage electron beam welding was employed for joining the 6061-T6 aluminum parts. Special joint configurations were developed to eliminate a tendency for the development of weld cracks. Weld repair techniques were also developed which prove the feasibility of using pre-placed filler metals. (auth)

18921 (WANL-TME-639) CONTROL ACTUATOR COMPONENT TEST 14/W001 TORQUEMOTOR TEST. Hornberger, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1963. 26p. Dep. NTIS $4.50.

The testing of a permanent magnet torquemotor used to convert the conditioned error signal from the actuator amplifier into a force capable of driving a servo-valve is reported. In order for the results to be comparable to actuator operating conditions, an effort was made to duplicate the actual driving (input) and loading (output) parameters and the environmental conditions of temperature and radiation environment for a test period of 116 hours. Upon examination after testing, the torquemotor evidenced no physical damage but, when the loading springs were removed, the free position of the armature was no longer in the middle of the pole gaps. Instead, it moved against one of the stops whenever it was displaced and released. This also occurred in previous tests at cryogenic temperatures. Essentially it is due to a loss of symmetry between the magnetic poles and the armature position. This is believed to be a low temperature effect, not related to radiation damage. The results of this screening test showed performance which was good, but left some doubt as to the exact nature of the 10 to 20% variation seen in both static and dynamic characteristics. Further tests are planned. (auth)

18922 (WANL-TME-642) WESTINGHOUSE ASTRONUCLEAR WANEF TRAINING PROGRAM. Ney, E. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Dec 1963. 27p. Dep. NTIS $4.50.

To ensure safety and efficiency in the performance of the proposed tests, a training program leading to the appointment of an initial operating staff for the Westinghouse Astronuclear Experimental Facility (WANEF) of the NERVA Program has been prepared, approved and executed. Subsequent training for facility personnel will follow explicitly the established procedures of WANL-TME-287, WANEF Operations Manual. (auth)

18923 (WANL-TME-657) CALIBRATION OF ACCELEROMETERS TO BE USED IN NRX-A-1 TEST. Polak, C. G.; Loftus, W. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jan 1964. 16p. Dep. NTIS $4.00.

On the basis of checks of frequency response, sensitivity and amplitude linearity, the accelerometers tested are considered satisfactory for the intended application. Deviations from the manufacturer's calibration (maximum 12.4 percent) may be due to differences in mounting and measuring techniques. (auth)

18924 (WANL-TME-680) NRX-A1 REACTOR SHIPPING REPORT. Bolender, D. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1964. 13p. Dep. NTIS $4.00.

The NRX-A1 reactor was shipped by rail on November 14, 1963 from Large, Pennsylvania to Las Vegas, Nevada, arriving on November 18, 1963. On November 19, 1963 the reactor was transported by tractor-trailer from Las Vegas to NRDS, Jackass Flats, Nevada. During the entire shipment, acceleration and displacement data were continuously recorded from transducers installed in the reactor and on the shipping container. Examination of the instrumentation data confirmed that the reactor accelerations induced by the transportation environment were of low magnitude. A visual and limited dimensional examination of the reactor at NRDS provided further proof that the reactor had not sustained any damage during the shipment. It is concluded that the methods, equipment, and procedures used to ship NRX-A1 are adequate to protect this type of assembled reactor from sustaining damage during rail and truck shipments. Minor refinements to the equipment and procedures will be incorporated for shipment of NRX-A2. (auth)

18925 (WANL-TME-686) TEST SPECIFICATION FOR CONTROL DRUM ACTUATOR COMPONENT (14/W003). Rich, R. B.; Cadoff, H. Y. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Feb 1964. 13p. Dep. NTIS $4.00.

Specifications are provided for a test of radiation effects on operating reactor components. (LTN)

18926 (WANL-TME-695) INEFFICIENCY OF FILM BOILING HEAT TRANSFER AND EFFECT ON REACTOR START-UP. Chi, J. W. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Feb 1964. 20p. Dep. NTIS $4.00.

From an experimental study on the cool-down of a copper tube by liquid hydrogen it was observed that in the film boiling regime, slug flow is the primary mechanism of two-phase flow. Moreover, a super-heated vapor was found to exist simultaneously with the liquid at its boiling point. These facts suggest that only a fraction of the total heat transferred during film boiling becomes heat of vaporization. A two-step film boiling heat transfer mechanism is postulated: first heat is transferred from the wall to the vapor, and then from the vapor to the liquid. The ratio of the second step to the first is defined as the efficiency of film boiling. Equations were derived and the efficiencies fo film boiling calculated from the experimental data. It was shown that the efficiency of film boiling heat transfer is indeed significantly less than one. The implications of this fact on reactor start-up can be inferred: Choking two-phase flow in the nozzle coolant passages will occur for a longer period when compared to the assumption that 100% of the heat transferred becomes heat of vaporization. Two-phase flow would appear in a greater part of the reactor, possibly penetrating the reflector. As a consequence, transient start-up may require a longer period. A correlation was developed which permits the estimation of the local heat flux from the vapor to the liquid. The application of this correlation to transient, reactor start-up analysis is discussed. (auth)

18927 (WANL-TME-706) PRELIMINARY GAMMA HEATING RESULTS ON NRX-A-2 PRESSURE TRANSDUCERS. Simoncini, M. V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Mar 1964. 11p. Dep. NTIS $4.00.

The ability of pressure transducers mounted in the shield region of NRX-A-2 to function properly with gamma heating had to be determined since excessive gamma heating could cause the transducers to exceed their temperature limits and, thus, fail. The problem was approached by first calculating the mass of the active elements inside each transducer and the temperature those elements would experience in use due to gamma heating. Then tests were conducted in an oven at these temperatures. With the correlation between the calculated results and test results, it can be stated that the Wiancko differential and absolute pressure transducers can be mounted in the shield region of the NRX-A-2 without failure due to gamma heating. The Wiancko differential unit would operate if the NRX-A-2 were run at 200% of full power without failure due to gamma heating. The Wiancko absolute transducer, however, could possibly fail above the 85% of full power level of the NRX-A-2. The CCC transducers would not fail due to gamma heating at the 100% power level. Therefore, all transducers now specified to be put into the shield region of the NRX-A-2 are acceptable except the Wiancko absolute transducer, which is acceptable if the power level does not exceed 85% of full power level. (auth)

18928 (WANL-TME-767) ANALYSIS OF KIWI B4A RADIATION MEASUREMENTS. Stephenson, L. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 May 1964. 55p. Dep. NTIS $5.75.

An analysis of the external radiation environment measurements made by the Los Alamos Scientific Laboratory during the testing of the KIWI-B4A reactor is described and includes a correlation of these measurements with other measurements made during the KIWI series of tests. The "point kernel" method was the main analytical technique used in this analysis. Neutron spectra were calculated using beryllium, carbon, and water moments data which had been developed as a function of penetration distance in an infinite medium. Fast neutron doses were calculated neutron spectra for beryllium and carbon and with the Modified Albert Welton kernel. Comparison of the calculated neutron spectra with the measured spectra shows reasonable agreement in the case of carbon and beryllium, but poor agreement in the case of water. Calculated neutron doses based on the beryllium and carbon spectra agree more closely with the measured data than do the calculated doses based on the Modified Albert Welton kernel. Both the calculated gamma dose and the neutron doses obtained from the beryllium and carbon spectra are within a factor of 1.5 of the doses measured on the reactor core midplane within 60 feet from the reactor. (auth)

18929 (WANL-TME-800) FINAL TEST SPECIFICATIONS FOR NRX-A CANDIDATE PRESSURE TRANSDUCERS TO BE IRRADIATED AT THE PLUM BROOK REACTOR (23/W506). Simoncini, M. V.; Solberg, D. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 May 1964. 13p. Dep. NTIS $4.00.

18930 (WANL-TME-824 (Rev. 3)) NERVA SUPPORT EQUIPMENT PROVISIONING LIST AND SCHEDULE FOR NRX-A7. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Sep 1964. 31p. Dep. NTIS $4.75.

18931 (WANL-TME-945) NRX-A2 CONTROL SYSTEMS DESCRIPTION. Elmiger, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 36p. Dep. NTIS $5.00.

The NRX-A2 Reactor Tests will be run at NRDS using the facilities at Test Cell "A". New control supplements have been added to the above facility and will be incorporated to provide the necessary controls for the reactor. These controls are described and plans for their use during the NRX-A2 test runs outlined. Particular emphasis is put on the temperature control system since this system has been revised considerably and provides for several alternate means of control. (auth)

18932 (WANL-TME-946) ADEQUACY OF TCA INSTRUMENTATION, DATA ACQUISITION AND DATA REDUCTION SYSTEMS FOR NRX-A3 TESTING. Corl, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Sep 1964. 98p. Dep. NTIS $8.00.

The NRDS Test Cell "A" instrumentation, data acquisition and data reduction system is described as it pertains to the scheduled

NRX-A3 reactor test. Based on all data requirements and inventories, the NRDS facilities are adequate for performing NRX-A3. One possible area of difficulty is that of low level, solid state multiplexers which must be borrowed from LASL to insure adequate performance of the data acquisition system. Although no modifications to existing facilities are necessary other than those already planned for the NRX-A3 test, extrapolation of present known data requirements for NRX-A4 indicate that some additional equipments must be made available and recommendations are made. (auth)

18933 (WANL-TME-955) K-SEAL TESTS USING DAMAGED SEALS. Edmiston, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Oct 1964. 17p. Dep. NTIS $4.00.

The results of tests on a damaged aluminum K-seal indicate that when the longer flexible sealing leg of the K-seal is effectively eliminated, the solid body of the seal can stop leaks at 240 ft-lb. This pre-supposes that the sealing surface of the port is in as good a condition as on the test fixture, i.e., no radial marks, blemishes, or scratches. A seal that did not leak under 100 psig ambient temperature helium for 120-ft-lb torque, leaked at 800 psig on helium at ambient temperature and beyond the previous recommended maximum at 800 psig on hydrogen at cryogenic temperature. It can be concluded that ambient temperature helium may indicate the same leak as hydrogen at test condition if the pressure drop across the seal is 800 psig. (auth)

18934 (WANL-TME-970) TEST SERIES FFL-13. Bar-X Seal Test in Oversize Port. Edmiston, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Oct 1964. 24p. Dep. NTIS $4.25.

The hazard introduced by hydrogen leaks out of a NERVA engine makes it imperative that a suitable remedy be determined for repair of damaged instrument port seals. This test demonstrated that the two-inch port could be increased 0.0043 inches in diameter beyond the manufacturer's recommended size and still effectively seal with the standard 2-inch Bar-X seal. (auth)

18935 (WANL-TME-977) CONTROL DRUM BOW TESTS (EML-48). Kallin, I. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 29p. Dep. NTIS $4.50.

A series of tests which simulated the thermal shock on a control drum during gaseous flow reactor startup were run and the distortion (thermal bow) resulting from this shock was measured. A number of material temperatures within the drum were also measured to aid in correlating this data with reactor analysis and test results. The highest bow measured was 0.038 in., and resulted from a simulated full reactor 5.0 lb/sec^2 ramp (maintained for 5 sec). Measurement showed that the drum was initially misaligned by 0.0025 in. in the opposite direction, so the actual thermal bow was 0.038 in. plus 0.0025 in., or 0.0405 in. (auth)

18936 (WANL-TME-988) CONTROL PLATE FRICTION TEST (EML-14). Leanza, E. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 8p. Dep. NTIS $4.00.

In preparation for the NRX-A2 and A3 reactor tests, one problem area considered was the possibility of control plate failure due to friction loads arising from differential thermal contractions between the control plate and the other drum components in contact with it. Fragments resulting from a plate failure could cause jamming of the drum and clogging of the drum coolant passages. Since it was difficult to predict the friction forces, it was decided to determine them experimentally. Tests were conducted at ambient temperature and at 140°R with the control drum in the "as assembled" condition and reworked to simulate nominal tolerance conditions. The force required to move the control plate in the "as assembled" condition was 12.6 lb at ambient temperature and 42.6 lb at 140°R. With the control drum in the reworked condition, the slip forces at room temperature and 140°R were found to be 48.7 and 1128 lb, respectively. (auth)

18937 (WANL-TME-989) SECTOR SPIGOT COMPRESSIVE LOAD TEST (EML-58). Kallin, I. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 10p. Dep. NTIS $4.00.

Since the sector spigot was not cracked at room temperature by a compressive load which was about twice as large as the load estimated to be capable of producing spigot failure at reactor temperature conditions, it is felt that the ductility change which the sector material (beryllium) undergoes when it is cooled from ambient to reactor operating temperature conditions has a very important effect on the load required to crack the spigot. Another test will be performed at 140°R to determine the reflector nozzle end ring compressive load and the resulting deflection required to crack the sector spigot under reactor temperature conditions. (auth)

18938 (WANL-TME-990) CONTROL DRUM FRICTION TEST (EML-49). Leanza, E. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 5p. Dep. NTIS $4.00.

During the NRX-A1 high flow ramp tests, control drum actuator stall was experienced. This difficulty was felt to be due to control drum and reflector sector bow resulting from transient thermal gradients in the drum and sector. In order to correlate drum-sector bow with drum turning torque, it was decided to perform friction tests in which a mechanically bowed drum would be rotated in a simulated reflector sector. The control drum was bowed to obtain effective drum-sector interferences of 0.003 to 0.015 in. For the range of interferences tested, torques of about 200 to 1200 in.-lb were measured, however the coefficient of friction developed was almost constant and varied from 0.32 to 0.40. (auth)

18939 (WANL-TME-1017) NRX-A2 FLOW LAG. Rovnak, J. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Oct 1964. 12p. Dep. NTIS $4.00.

During NRX-A1 and NRX-A2 tests, a flow lag between demand flow and nozzle chamber measured flow was observed. It has been found that the major part of the flow lag is accountable for as stored fluid in the mixing chamber and feedline piping. Minor contributions (about 15%) to the flow lag are attributed to storage in the reactor voids and inadvertent bypass through AVV-2. A method of avoiding difficulty in reactor tests from this behavior is suggested. (auth)

18940 (WANL-TME-1018) OPERATIONAL SUPPORT PLAN FOR COLD FLOW DEVELOPMENT TEST SYSTEM. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Oct 1964. 36p. Dep. NTIS $5.00.

Support equipment needed for the Cold Flow Development Test System (CFDTS) is described with schedules for design, purchase or fabrication, inspection, etc. (LTN)

18941 (WANL-TME-1027) NRX-A CANDIDATE DIAGNOSTIC PRESSURE TRANSDUCERS IRRADIATED AT PLUM BROOK REACTOR FACILITY (CYCLE 16,PB No. 6W). Freas, D. G.; Blinn, H. O.; Simoncini, M. V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1964. 46p. Dep. NTIS $5.50.

Candidate diagnostic pressure transducers were irradiated under dynamic test conditions in the HT-1 Facility of the Plum Brook Reactor for 18 hours at a reactor power of 42.7 MW. During the irradiation, gamma heating raised the temperature to more than 975°F, with the actual temperature being determined by position and design tolerances (which are extremely significant in controlling heat dissipation). The high temperature resulted in increased coil resistance, decreased insulation resistance, with some some permanent damage to some units usually occurring above 1100°F and probably resulting from differential thermal expansion. (LTN)

18942 (WANL-TME-1057(Rev.1)) PRELIMINARY EVALUATION OF PRESSURE DROP AND TEMPERATURE RISE IN EST PUMP SUCTION LINE. Farquhar, N. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Aug 1965. 14p. Dep. NTIS $4.00.

Test Cell "A" propellant piping is being modified to provide a piping system suitable for NRX/EST tests. A new pump suction line will supply liquid hydrogen from the dewars to the NRX/EST test car interface. Predicted operating characteristics of the pump suction line have been prepared to assist in the planning of facility checkout tests to establish the actual operating characteristics. The predicted temperature changes in the line may not be sufficiently accurate for low flow rates (less than 3 lb/s) where small changes in estimated heat leakage cause large changes in temperature. The possibility of vapor formation in the venturi throat and a resulting flow instability is discussed and conditions for avoiding such a possibility recommended. (auth)

18943 (WANL-TME-1161) PLAN FOR TEST CELL A NARROW BAND DATA ACQUISITION ACCURACY TEST. Blau, P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Jun 1965. 48p. Dep. NTIS $5.50.

Test specifications for narrow band data acquisition systems are described. The tests are designed to determine error band limits, linearity, drift, noise, zero offset, frequency response, cross talk problems, etc., and provide data that would permit separation of instrument and channel errors if large errors are encountered. (LTN)

18944 (WANL-TME-1168) ANALYSIS AND SIMULATION FEASIBILITY STUDY FOR NRX-A ON-OFF CONTROLLER.

Honka, E.; Josephson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 May 1965. 45p. Dep. NTIS $5.25.

A preliminary analysis and analog computer simulation study was made to establish the feasibility of an on-off drum actuator in the power control loop. The on-off type actuator will result in a simpler, more reliable, lighter and less expensive system than that presently in use for the NRX-A reactors. The actuator would be characterized by a low constant velocity output when errors in the system are large enough to require control drum movement. The position feedback loop would be eliminated along with the feedback potentiometers which have proved to be the weakest component of the present actuator system with respect to reliability. With the system under investigation the control drums would be mechanically ganged together to maintain relative positions. This could result in fewer actuators being required for the reactor. Other methods of synchronizing the drums are possible and should be investigated if mechanically coupled drums prove to be not feasible. The results show that an on-off controller will meet the general engine system performance requirements as postulated at this time and that the system response with an on-off actuator and little or no compensation can be made comparable to that of a continuous analog type system. Techniques which can be used to improve an on-off controller have also been formulated and demonstrated. (auth)

18945 (WANL-TME-1185) ADEQUACY OF TCA INSTRUMENTATION, DATA ACQUISITION AND DATA REDUCTION SYSTEMS FOR NRX/EST TESTING. Corl, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1965. 108p. Dep. NTIS $8.50.

The NRDS Test Cell "A" instrumentation, data acquisition and data reduction system is described as it pertains to the scheduled NRX/EST reactor test. Based on all data requirements and inventories, the NRDS facilities are adequate for performing NRX/EST, with the exception of the wide band data system. Approximately 18 more wide band measurements are expected to be added to the measurement requirements list thus increasing the total number of wide band measurements to 157. If this is the case, the required wide band measurements will exceed the capability of the cabling of the wide band data system (150 channels). This problem may be resolved either by reducing the number of wide band measurements via the Instrumentation Committee or by adding triplex cables (long lines) between the Control Point and Test Cell 'A' to allow utilization of the full 200 channels of wide band equipment already in existence. Although no modifications to existing facilities are necessary other than those already planned for the NRX/EST test, extrapolation of present known data requirements for NRX-A5 indicate that some additional equipment may be necessary. Recommendations are given to alleviate certain equipment deficiencies which presently exist. (auth)

18946 (WANL-TME-1205) INTERNAL INSTRUMENTATION CABLE TRANSITIONING. Chambers, G. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jun 1965. 21p. Dep. NTIS $4.25.

Progress on a technique for transitioning (splicing) small instrumentation cables, which is strong and withstands radiation levels and temperature conditions internal to the NERVA reactor, is described. With a transition boot positioned up cable, the conductors are spliced by brazing, then brazed to an adapter, the boot positioned and brazed to the adapter and filled with Saureisen DW 30 inorganic cement which is then cured. A glass preform was used to protect the brazed connecter joint during curing of the cement. (LTN)

18947 (WANL-TME-1209) BUCKLING TESTS OF SCALED GRAPHITE BARREL INNER REFLECTORS. Krebs, A. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Jul 1965. 34p. Dep. NTIS $4.75.

Larger inner reflectors of high strength graphite have been considered for use in advanced nuclear rocket designs. These reflectors are too large for one-piece construction from presently available, high-strength graphites. To permit the use of small stock sizes of high-strength graphites, some proposed new designs specify that the reflectors be made from cylindrical sectors assembled as stave-type barrels. Buckling tests which were performed on miniature (6 inch diameter) barrels of high-strength, fine-grained, isostatically molded P-03 graphite are described. This material had an average tensile strength at room temperature of 4865 psi and a compressive strength of 17,945 psi. By comparison the H4LM graphite, from which the NRX-A1, NRX-A2, and NRX-A3 inner reflectors were made, had an average tensile strength of only 1926 psi and a compressive strength of only 6445 psi. The test specimens were geometrically scaled to simulate the proposed full scale inner reflector barrels. Three types of barrels were tested; one-piece (non-stave) barrels, bonded stave barrels and unbonded stave barrels. Pressure tests on the miniature barrels demonstrated the suitability of the stave-type barrel construction for fabrication of graphite inner reflectors. Classic external buckling pressure calculations, used for the design of one-piece barrels, appear to be suitable for stave-type barrel designs. Stave-type barrels were 85 to 90 percent of the strength of one-piece barrels, but the number of samples tested was too limited to establish quantitative design data on this strength differential. With both external and internal radial restraints in use, the buckling strengths were more than quadruple those of the radially unrestrained barrels. One-piece (non-stave) barrels and bonded-stave barrels exhibited almost identical buckling characteristics when subjected to equivalent test parameters of radial restraint and pressure. Due to buckling instability, it appears impractical to use unbonded stave-type barrels for inner reflectors without radial restraint built into the design. (auth)

18948 (WANL-TME-1217) ANALYSIS OF NRX-A3 AMBIENT GH_2 FLOW SHUTDOWN SYSTEM. Rovnak, J. A.; Lance, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 55p. Dep. NTIS $5.75.

A spurious turbopump overspeed trip occurred during the NRX-A3 power test, Experimental Plan IV, causing a flow shutdown. During the flow shutdown, the ambient GH_2 emergency system did not maintain adequate coolant flow to the test article and overheating of the reactor tie rods resulted. To insure protection of the test article in the event a flow shutdown occurred in subsequent experimental tests, the pressure control loop of the ambient GH_2 emergency system was modified. An analog computer model, validated by the data obtained during Experimental Plan IV, was used to evaluate the system. This analysis shows that the ambient GH_2 emergency system, with the pressure control loop modifications, is adequate to successfully cool the reactor in the event of a flow shutdown. The analog computer study also shows that flow shutdown system performance is improved by maintaining the ambient gas inlet line at the reactor liquid feedline pressure. (auth)

18949 (WANL-TME-1223) FINAL TEST SPECIFICATIONS FOR THE NRX-A CANDIDATE PRESSURE TRANSDUCERS TO BE IRRADIATED AT THE PLUM BROOK REACTOR (23/W508). Simoncini, M. V.; Welsh, R. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1965. 19p. Dep. NTIS $4.00.

18950 (WANL-TME-1223(Suppl.)) MODIFICATION TO FINAL TEST SPECIFICATION FOR NRX-A CANDIDATE PRESSURE TRANSDUCERS TO BE IRRADIATED AT THE PLUM BROOK REACTOR (23/W508). Simoncini, M. V.; Welsh, R. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 Oct 1965. 11p. Dep. NTIS $4.00.

18951 (WANL-TME-1229) ANALYSIS OF NRX-A3 EP-VI CONTROL TEST RESULTS. Josephson, J.; Cooper, K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 35p. Dep. NTIS $4.75.

The tests performed on NRX-A3 EP-VI verified that a stable pressure control system can be designed for the control of a reactor, and provided a limited amount of data for use in developing mathematical and analog models of the reactor and feed system. Now that the operation of a pressure controller has been established, a redesign of the pressure controller can be undertaken to improve the response time of the system. Recommendations are made for improving the system and the analog model of it. Recommendations are also made for the testing of controlling and for the data acquisition systems used in such tests. (auth)

18952 (WANL-TME-1256) WANL CALIBRATIONS FOR NRX-A5. Burlas, T. C.; Karako, E. F.; Haselberger, F. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Sep 1965. 21p. Dep. NTIS $4.25.

18953 (WANL-TME-1261) TRANSFER FUNCTION MEASUREMENTS DURING THE NRX-A3 TEST SERIES. Steiner, G. H.; Bodenschatz, C. A.; Wasserman, A. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 139p. Dep. NTIS $10.00.

Cross-correlation experiments for the measurement of various system transfer functions were performed in both the NRX-A2 and NRX-A3 test series. The main objective was a demonstration of the feasibility of the basic technique; i.e., that pseudo-random signals with amplitudes near background noise levels could be inserted at several different locations within the NERVA reactor system during steady state holds and meaningful system transfer function results derived without interfering with other test objectives. Major improvements were made in data acquisition and data processing techniques. Two sets of NRX-A3 transfer function test data have been analyzed: a feedsystem test with an orifice used to simulate the hydraulic impedance of the test article, and the NRX-A3 EP-IV Full Power (Reactor) Test. It was concluded that cross-correlation is an accurate, practical, and advantageous method for NERVA transfer function measurements. It requires less test time and smaller amplitudes than sinusoidal measurements, provides greater frequency resolution, and automatically gives a measure of the precision of the data. (auth)

18954 (WANL-TME-1270) ANALYSIS OF PCV-41 CONTROL SYSTEM (U). Cooper, K.; Josephson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1965. 23p. Dep. NTIS $4.25.

The function of the PCV-41 control system is to provide sufficient hydrogen gas flow to cool the reactor and nozzle in the event of an emergency shutdown. This is accomplished by a closed-loop pressure control system which maintains the nozzle torus pressure at a value determined as satisfactory for the initial conditions of shutdown. This pressure was established at 600 psi upon the recommendation of Reactor Analysis based on maintaining the tie rod temperature below 1600°R. Subsequent to the initial design, an additional system requirement on gas flowrate into the nozzle was established. For 100 percent power as an initial condition of shutdown, it is required that the PCV-41 system maintain a minimum gas flowrate of 22 pounds per second into the nozzle torus to protect the nozzle tubes when the system is operating in the EST configuration. The additional flow rate requirement made it necessary to increase the steady state demanded nozzle torus pressure to 660 psi. In addition to the increase in steady state demanded nozzle torus pressure, it was necessary to add an exponentially decaying demand signal to the steady state signal. This was necessary to insure that the gas flow to the nozzle torus would not go below 22 pounds per second during the transient period. There are two transient periods when the PCV-41 system is activated, first at the instant of shutdown, and second, when all of the liquid in the system at the time of shutdown has been forced through the nozzle tubes. (auth)

18955 (WANL-TME-1277) CONTROL DRUM BEARING VIBRATION TEST (EML-85). Telischi, B. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1965. 14p. Dep. NTIS $4.00.

A series of vibration tests were run at reactor temperature conditions to determine whether the control drum bearings could withstand the critical axial vibrations that might occur during ground tests of the NRX-A reactors. Additional tests will be required to evaluate the bearings under space operating conditions. The tests consisted of vibration surveys to determine the critical resonances and one hour dwell tests at each of these resonances to determine whether the bearings would be damaged by exposure to these conditions. The surveys were performed over an envelope of frequency and acceleration conditions which included the most severe vibration conditions expected during reactor testing. A total of 5 hours of dwell tests at accelerations from 2.2 to 20 G's and frequencies from 14 to 1,844 Hz were carried out. The vibration inputs during the tests were controlled at the dome end of the simulated outer reflector where the control drum thrust bearing was located. The friction torque of the bearings was about 15 in.-lb. and remained unchanged throughout the tests. Inspections of the bearings before and after the tests revealed no changes in dimensions or appearance of the balls or races. (auth)

18956 (WANL-TME-1295) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY OPERATING LIMITS. Frantz, F. S. Jr. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1965. 23p. Dep. NTIS $4.25.

The PAX and FCX critical assemblies are described and, in accordance with AECM 8401-044, the limits are defined within which these AEC-owned reactors can be operated with reasonable assurance that their operation will not result in undue hazard. Included are those design specifications, operating variables, operating procedures and administrative procedures which can significantly influence safe operation and which are under the ready control of the Westinghouse Astronuclear Laboratory. Effluent discharge from the facility is limited to values set forth in AECM Chapter 0524, "Standards for Radiation Protection." (auth)

18957 (WANL-TME-1296) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY EXPERIMENTAL PROGRAM NERVA CONTRACT YEARS 1966–1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1965. 40p. Dep. NTIS $5.00.

A description and schedule of nuclear experimentation to be conducted at the Westinghouse Astronuclear Experimental Facility (WANEF) in CY-66 and CY-67 has been prepared. The primary portion of the description was developed from test objectives and justifications prepared by the analytical groups of the WANL Reactor Analysis Department and then scheduled for performance in accordance with present WANL equipment and program schedules. (auth)

18958 (WANL-TME-1301) PRELIMINARY NRX-A5 CONTROL SYSTEMS PREDICTIONS. Walsh, J. M.; Josephson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Sep 1965. 15p. Dep. NTIS $4.00.

The NRX-A5 reactor test will be run with some changes to the basic controller and with the addition of several new control concepts. These changes and additions are a result of past reactor experience and the continuing need to develop and checkout improved control concepts for application to the X Engine series. The changes to the basic controllers will include a simplification of the power controller circuitry to reduce the number of amplifiers and increase reliability, a reinvestigation to evaluate the compensation on all controllers, and a redesign of the limiter circuits to provide more safety during "fixed drum" tests. New controllers to be evaluated during NRX-A5 are aimed primarily at removing the flux loop entirely from controller operation and providing a wider margin of safety for reactor testing. The new controller tests will include both a high power transient test of the "on-off" temperature controller with the maximum outward velocity of the control drums restricted to approximately 5 degrees per second, and an automatic startup circuit which does not require a flux loop or any "in-line" switching. Sinusoidal oscillation experiments will also be performed during the NRX-A5 tests in order to evaluate controller operation, acquire system dynamic transfer function data, and serve as a check on more extensive cross correlation experiments. (auth)

18959 (WANL-TME-1304) WESTINGHOUSE ASTRONUCLEAR WANEF FCX TRAINING PROGRAM. Kovacik, W. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1965. 16p. Dep. NTIS $4.00.

A training program to assure the safe and efficient activation of the Flexible Critical Experiment (FCX) has been prepared for those WANEF staff members who are already qualified as PAX operators. (auth)

18960 (WANL-TME-1316) NRX-A5: PROVISIONING LIST AND SCHEDULE. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Feb 1966. 226p. Dep. NTIS $14.50.

A revised, detailed list of support equipment needed for the NRX-A5 reactor is provided with design, procurement or fabrication, inspection, etc. schedules for each item. (LTN)

18961 (WANL-TME-1332) IMPROVED ELECTRON BEAM WELD PROCESS FOR CONTROL DRUM ASSEMBLY. Stemann, L. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 18p. Dep. NTIS $4.00.

An improved high voltage electron beam weld process has been developed and a production facility established within the Westinghouse Astronuclear Laboratory Materials Department. This procedure has eliminated many of the periodic weld defects produced by an outside vendor. The preplacement of 4043 aluminum alloy filler material, which was proven feasible in previous work (TME-625), was successfully applied to reduce the crack sensitivity of welds. While the fusion zone was slightly larger with the new weld parameters, distortion level during joining was not adversely affected. The very close control of end to end length and axial alignment maintained by the process permits all final machining to be accomplished before welding. (auth)

18962 (WANL-TME-1337) PCV-41 PRESSURE CONTROL SYSTEM. Experimental Checkout and Subsequent Analysis (U). Cooper, K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Feb 1966. 26p. Dep. NTIS $4.50.

Prior to the facility checkout testing, an analysis and analog computer study of the PCV-41 Pressure Control System was conducted. The results were used to design the original controller compensation and to predict the operation of the system. During the facility checkout series and EP-IA prime of the NRX/EST test series, data on the PCV-41 Pressure Control System was obtained. This data was used to validate the analog computer simulation of the PCV-41 system and to adjust the PCV-41 Pressure Control System compensation. Analysis of analog computer flow shutdown experiments showed that the PCV-41 Pressure Control System would meet the reactor and nozzle requirements for protecting the test article during a flow shutdown. (auth)

18963 (WANL-TME-1338) DIGITAL PROGRAMS FOR OBTAINING THE SYSTEM FREQUENCY RESPONSES FROM TIME RESPONSES FOR IMPULSE, STEP OR ARBITRARY INPUTS (U). Honka, E.; Joseph, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1966. 77p. Dep. NTIS $7.00.

Computer codes are provided for computing system frequency responses from time responses for impulse, step or arbitrary inputs. They have been modified to derive the closed loop frequency response with unity feedback when the original transient response measurements were performed for an open loop system, and vice versa. (LTN)

18964 (WANL-TME-1347(Suppl. 1)) ANALYSIS OF PERFORMANCE OF PCV-41 FLOW SHUTDOWN SYSTEM FOR NRX/EST ENGINE SYSTEM TESTING. Rovnak, J. A.; Buker, J. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Feb 1966. 36p. Dep. NTIS $5.00.

Results of recent studies made with a refined model of the NRX/EST PCV-41 emergency cooling system are presented. Included are (1) a brief discussion of the operation of the PCV-41 flow shutdown system, (2) a description of the revisions made to the analog computer model since the last PCV-41 performance analysis report, (3) a comparison between predicted and measured transients during the NRX/EST EP-IA Prime test, and (4) an analysis of the new analog results to confirm the suitability of the current PCV-41 controller design. Also included is a complete presentation of the equations which comprise the latest PCV-41 emergency cooling system model. (auth)

18965 (WANL-TME-1374) FLOWCHART PROGRAM. Saalbach, C. P.; Sapovchak, B. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1966. 45p. Dep. NTIS $5.25.

The FLOWCHART program accepts, as input, special FORTRAN comment cards and, by means of SC-4020 output, produces a flowchart of the program. These input cards contain directions for the plotting of command or decision flowchart figures and for the labeling of these figures when necessary. The appearance of the flowchart on the paper is under the complete control of the user of the program. The program was written to produce flowcharts from special FORTRAN comment cards so that the flowchart of a FORTRAN program is an integral part of the program itself. Anytime the program is changed, the flowchart comment cards are modified or added to the program to reflect this change. When a new flowchart of the program is required, the FORTRAN deck is input to the FLOWCHART program and the current flowchart is produced. There should no longer be any discrepancy between the latest FORTRAN compilation and the existing flowchart of the program. (auth)

18966 (WANL-TME-1383(Rev.2)) NRX-A5 OPERATING LIMITS DOCUMENT. Hemmerle, E. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Apr 1966. 33p. Dep. NTIS $4.75.

WANL-TME-1383 was prepared to cover pre-test operations to be performed in the R-MAD Building up to, but not including, removal of the central poison wire system. Revision 1 extended its coverage to include central poison wire removal and other planned operations to be performed prior to initial criticality. Revision 2 is a complete NRX-A5 Operating Limits Document covering all operations including preparation for testing, power operation and return of the reactor to the R-MAD Building. (auth)

18967 (WANL-TME-1387) WANEF ANNUAL OPERATIONS REPORT, 1965. Barksdale, C. E.; Frantz, F. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 25p. Dep. NTIS $4.25.

A standard set of experiments was performed on the PAX-B, PAX-C, and PAX-D reactors in 1965. These measurements included fuel loading and initial criticality, power distributions, integral and differential drum worths and reactivity coefficients for various reactor materials. Additional experiments performed as required included: reactor shutdown determinations utilizing the pulsed neutron generator (PNG), attenuation experiments with three different shield configurations, and neutron streaming experiments. The mechanical and electrical assembly of the Flexible Critical Experiment (FCX) reactor was completed, but no fueled operations have been performed. Reactor operations were conducted safely with no indication of possible hazards or unsafe conditions. (auth)

18968 (WANL-TME-1390) ON-OFF TEMPERATURE CONTROLLER. Honka, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Mar 1966. 70p. Dep. NTIS $6.50.

The present NERVA engine control system consists of three basic control loops. These are the power, temperature, and pressure loops. Analysis has shown that it is advantageous to eliminate the power loop. Therefore, the On-Off controller was developed to control temperature directly without an inner power loop. The basic reason for selecting an On-Off controller is the potential simplicity, reliability, and lower cost of a constant-rate drum actuator. Also, the maximum required drum actuator velocity, ±1°/sec., makes the system very attractive from the safety point of view. This actuator will move the reactor control drums in or out at a constant velocity or keep the drums stationary depending on the control signal. The On-Off controller was designed with the aid of analog computer studies and will be tested on NRX/EST. (auth)

18969 (WANL-TME-1392) OPERATIONAL MANUAL FOR ETS-1 TSCS DRUM CONTROL AND SUB-POWER CONTROLLER CHASSIS. Brinda, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Mar 1966. 34p. Dep. NTIS $4.75.

The WANL Drum Control and Sub-Power Controller Chassis is a rack mounted, all solid-state, control unit for manually checking out, from the test cell building, the actuators and drums of the test NERVA engine. Controls and indications are provided for selecting, unlocking and exercising individual drums. Conveniently located test jacks permit the introduction of forcing function input signals, as well as the measuring of the response and other signals in the drums control system. The Drum Control and Sub-Power Controller provides signals for the Actuator Amplifier Units which, in turn, command and control the actuators and drums of the NERVA engine. (auth)

18970 (WANL-TME-1408) NRX-A5 CONTROL DRUM BOW TESTS. Igne, E. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 22p. Dep. NTIS $4.50.

Control drum thermal bow tests were performed with an NRX-A5 type control drum. This drum incorporates a cooling slot diametrically opposite the control plate slot. Helium gas flows were used to simulate the startup hydrogen flow ramps expected during reactor testing. A series of tests were performed with an initial drum temperature of 590°R and flow ramps of approximately 1.0, 2.0 and 3.0 lb/sec^2 to determine the effects of flow ramp. Additional tests were performed with a flow ramp of 1.0 lb/sec^2 and initial drum temperature of 660 and 720°R to determine the effects of initial drum temperature. The results obtained indicated that neither the startup flow ramp nor the drum initial temperature had an important influence on the thermal bow, and the maximum startup bow during the planned NRX-A5 tests, excluding nuclear heating effects, should be less than 0.020 inches. Preliminary calculations indicate that the effects of nuclear heating should not significantly increase the maximum bow beyond 0.020 inch. (auth)

18971 (WANL-TME-1434F(Vol.2)) NRX-A6: PROVISIONING LIST AND SCHEDULE. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Mar 1968. 228p. Dep. NTIS $14.50.

18972 (WANL-TME-1453) WANL CALIBRATION FOR NRX-A6. Burlas, T. C.; Karako, E. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Oct 1967. 202p. Dep. NTIS $13.25.

18973 (WANL-TME-1453(Rev.A)) WANL CALIBRATION FOR NRX-A6. Burlas, T. C.; Karako, E. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Dec 1967. 39p. Dep. NTIS $5.00.

18974 (WANL-TME-1501(Rev.A,B,C)) WANL CALIBRATIONS FOR XE-1. Burlas, T. C.; Karako, E. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Apr 1967. 208p. Dep. NTIS $13.50.

Calibrations for XE-1 reactor instrumentation are provided. (LTN)

18975 (WANL-TME-1531) NERVA RADIATION EFFECTS TEST PROGRAM FOR CY 1967. Blinn, H. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1966. 48p. Dep. NTIS $5.50.

The WANL Radiation Effects Test Program is presented for the contract year 1967 (October 1, 1966, to September 30, 1967). The program consists of radiation effects testing at three locations: the Plum Brook test reactor operated by NASA at Sandusky, Ohio, the GTR facility operated by the General Dynamics Corporation at Fort Worth, Texas, and the NERVA reactor test (NRX-A6) to be conducted at the Nevada Test Site. The schedule and a descriptive test plan is presented for fifteen tests selected to provide data of the maximum value to the NERVA program within the means available. The tests include materials irradiation, where accumulated neutron exposure is of prime importance, and instrumentation irradiation tests which must be performed to determine the effects of both neutron damage to the components and internal heating due to gamma radiation. (auth)

18976 (WANL-TME-1599) NRX-A6/TEST CELL C TEST SYSTEM FAILURE MODE ANALYSIS. Manion, J. R.; Harley, C. G.; Starek, R. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Jul 1967. 177p. Dep. NTIS $12.00.

A detailed failure mode analysis has been carried out for each of the subsystems of the NRX-A6 Test Cell "C." The final function of each subsystem is identified and possible modes of failure studied to determine their cause and their effects on the total system. Failure mode analysis is carried out to ensure that all facets of system malfunction have been considered and action taken to eliminate causes or to minimize the likelihood of critical failure modes. When critical failure modes exist, assurance is required that safe shutdown can be implemented. (LTN)

18977 (WANL-TME-1613(Suppl.1)) NRX-A6 TEST PREDICTION REPORT. Knecht, W. L.; Rovnak, J. A. (eds.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1967. 82p. Dep. NTIS $7.25.

Several preliminary tests and one reactor endurance test are planned on the NRX-A6 reactor at Test Cell "C" of the Nuclear Rocket Development Station in Nevada. These tests have been planned to provide significant development information on the design and operating performance of the test article assembly. Analytical predictions of the behavior of the test article during the planned tests have been calculated. These predictions will be compared to test data during and after the test to establish whether the reactor performs in the expected manner. Included are predictions for normal operation and for emergency shutdown. (auth)

18978 (WANL-TME-1614) ANALYSIS OF XE-1 SAMPLE DATA PERIOD LIMITER PERFORMANCE. Schatz, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Jan 1968. 40p. Dep. NTIS $5.00.

The analysis presented demonstrates the following capabilities of the XE-1 sample data period limiter (SDPL): (1) Lower noise gain than the normalized NRX-A5 period circuit, particularly at frequencies above the control range. (2) Dead band (ΔS_L) can be set at a number of discrete values from the LRE Console. Large values may be used when the reactor is operating in the low power range resulting in lower noise gain for the SDPL while still constraining Control Vane Excursion Energy to less than the vane melting threshold at the reactor midplane. (3) Period Limit set point can be set up from the LRE Console at a number of discrete values. (4) Reliability is equivalent to that of a normalized NRX-A5 Period Safety Loop. (auth)

18979 (WANL-TME-1623) A-6 PYROFOIL WRAPPER STRAIN CAPABILITY PREREQUISITE PROOF TESTS (EML-93). Hengstenberg, T. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 6p. Dep. NTIS $4.00.

The integrity of the pyrofoil wrapper as a peripheral barrier in the NRX-A6 reactor depends, to a large extent, on the ability of the pyrofoil to withstand the strain imposed by the thermal growth of the core. The developmental program indicated that the unstabilized pyrofoil was at least 25 percent more ductile than the outgassed foil and would withstand straining beyond the amount anticipated in the reactor. The estimated total strain induced in the pyrofoil wrap at the maximum temperature is 1.0 to 1.4 percent depending on the slack in the wrapper. (auth)

18980 (WANL-TME-1672) STATUS OF WANL DYNAMIC DATA PROCESSING CODES AND TECHNIQUES APPLICABLE TO NERVA. Steiner, G. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1967. 44p. Dep. NTIS $5.25.

Cross-correlation transfer function measurement techniques as applied to NERVA have been developed by WANL during three years experience with NRX-A2, NRX-A3, NRX/EST and NRX-A5 reactor tests. Although various stages of the development have been reported previously, a single document that presents a comprehensive discussion of the theoretical considerations, the factors involved in test planning and predictions, the considerations in making the actual measurements and data acquisition, problem areas, and a description of the processing codes (including detailed operational mechanics), does not exist at present. The objective of this report, the first of a two-volume series, is to present an overall discussion, omitting discussion of the detailed mechanics of the processing codes which will be the subject of the second volume. The present status of the processing codes and the techniques as applied to NERVA is described. It is concluded that transfer function measurements using the cross-correlation technique can be made over a band of frequencies by using a low-amplitude, pseudo-random, binary input signal to the reactor/engine system. Experience thus far has shown that transfer function measurements can best be made by a combination of step and pseudo-random analyses techniques, particularly when test time is limited. Low frequency data are obtained from the step response and higher frequency data from the pseudo-random response. This approach is planned for the XE tests. (auth)

18981 (WANL-TME-1684) FUNCTIONAL REQUIREMENTS OF THE NUCLEAR SUBSYSTEM PORTIONS OF A FLIGHT DATA ACQUISITION SYSTEM FOR NUCLEAR MODULES. Corl, C. E.; Vuckovich, M.; Weldon, T. P.; Yaroshuk, N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1967. 71p. Dep. NTIS $6.75.

A review of the data processing requirements for flight type nuclear modules is presented. The equipment requirements for developmental flight test modules are determined by the analysis of interplanetary mission requirements. The flight data acquisition system equipment must be proven in early nuclear module ground tests. A system design is proposed satisfying the information requirements of the astronauts and earth monitoring stations based upon nuclear module measurements and operating requirements. A program for system and hardware development is recommended in parallel with engine development programs. The flow of data for the nuclear sub-system is from the transducer to telemetry. (auth)

18982 (WANL-TME-1687(Rev.A)) WANL CALIBRATION FOR XE-PRIME. Burlas, T. C.; Karako, E. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1969. 179p. Dep. NTIS $12.00.

The calibration data for all WANL instrumentation installed on the XE-2 Reactor is supplied. (auth)

18983 (WANL-TME-1691) NRX-A6 PLUNGER PIN CAPSULE SEAL LEAKAGE TEST. Edmiston, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Oct 1967. 22p. Dep NTIS $4.25.

Plunger pin capsules have been incorporated into the NRX-A6 reactor reflector. These capsules allow the gas to flow axially through the reflector coolant passages penetrated perpendicularly by the plunger pins, but preclude gas flow radially inward along the plunger pins. This test program evaluates the seals that are integral parts of the capsule assembly. The plunger pin capsule is titanium, the seals are copper, and the reflector piece is beryllium; therefore, temperature changes must be considered in determining the seal effectiveness. The initial seal design resembled a piggy-backed double-diamond in cross section. Subsequent seal designs were: the initial seal modified by removal of the outer flange, and an L-shaped seal. The two later seal designs were equally acceptable and much more satisfactory than the initial design. The NRX-A6 incorporated the improved seals as a result of the development program reported herein. (auth)

18984 (WANL-TME-1692) NRX-A6 SERIES FLOW IMPEDANCE TESTS ON CONTROL DRUM BEARINGS. Edmiston, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Oct 1967. 22p. Dep. NTIS $4.25.

In the initial NRX-A6 reactor design, the inlet to the control drum cooling annulus included a restriction-to-flow between a single step or ring projecting axially from the bearing shaft drum end cap and a recessed step in the outer bearing race. This restriction was later opened due to control vane thermal gradients and the incorporation of by-pass flow around the core periphery. A series of tests were made to evaluate such a simple step flow impedance design. The impedance ring tests were performed with up to 0.02 pps of hydrogen gas at the ambient temperature and at an inlet pressure level of 734.5 psia. The double step impedance resulted in a loss coefficient of 1.59 for a radial clearance of .003 inches and an axial clearance of .030 inches. This design was considered acceptable for reactor application. The single step impedance had a loss coefficient of 0.93 for the same clearances. Additional tests were conducted to obtain the pressure drop through the bearing. The bearing pressure drop tests were conducted with up to 0.15 pps of air at ambient temperature and at an inlet pressure level of 100 psia. (auth)

18985 (WANL-TME-1706) INITIAL STUDY OF SPACE ENVIRONMENT IN THE NUCLEAR SUBSYSTEM. Stumpf, H. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1967. 29p. Dep. NTIS $4.50.

An estimate of the pressure environment of the nuclear subsystem was made for a lunar transfer and a manned Mars mission. The system was represented by a lumped parameter model, and gas sources due to graphite outgassing and propellant boiloff were considered. A lower bound on the system pressure can be found by computing the steady state pressure in the core exit plenum since this represents the lowest pressure in the system. For the lunar transfer mission this pressure was found to be 7×10^{-6} torr prior to the suborbital start with a completely open nozzle, 8×10^{-4} torr prior to a cooling pulse early in the pulse cooling cycle, and 3×10^{-4} torr prior to a cooling pulse near the end of the pulse cooling cycle. Two cases were considered for the manned Mars mission. If outgassing of water vapor is the only gas source considered, the pressure in the core exit plenum for an open nozzle varied from 3.48×10^{-6} torr 100 minutes after launch to 7.23×10^{-10} torr 350 days after launch. If six pounds per day of propellant are bled into the system the core exit plenum pressure is 6.75×10^{-3} torr. If it is assumed that the bleed is divided equally among the pump discharge line, reflector inlet plenum, and upper plenum, the pressure at these locations for an open nozzle are 1.43 torr, 7.9×10^{-1} torr, and 4.7×10^{-1} torr, respectively. These pressures will not be affected greatly by the poison wire retraction plate unless it blocks more than 99.9% of the nozzle throat area. (auth)

18986 (WANL-TME-1734) REPORT ON THE RESULTS OF QUALIFICATION TESTING OF RE-DESIGNED PNEUMATIC ACTUATOR SHUT-OFF VALVES. Greenaway, P. R.; Jelovich, J. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1968. 21p. Dep. NTIS $4.25.

The XE-1 pneumatic actuators delivered to NTO for installation in the XE-1 test reactor were reworked to increase lock pin clearance and thus remove a potential failure area from actuator lock mechanisms. One actuator lock shutoff valve solenoid had a low coil resistance and was rejected. As a direct result of the investigation into this failure the shutoff valve solenoid was redesigned to use PYRE-ML enameled wire in lieu of the former brittle ceramic coated wire. The enameled wire was to be wound while being wetted with PYRE-ML varnish so as to totally encapsulate each winding and finally the entire coil. The XE-1 qualification test involved a series of environmental tests to demonstrate the ability of the new valve design to withstand the anticipated XE test environments. All valves successfully completed all phases of the tests required and on the basis of this successful demonstration, the re-designed version of the pneumatic actuator shutoff valve is considered qualified for XE application for all environments tested. Although it is not the intent of this test to determine qualification of the valves in a radiation environment, the results of the NRX-A6 side by side test, although qualitative, indicate that no damage occurred to the lock solenoid shutoff valve under the doses received in this test. Lock operation was normal before, during, and after the A-6 reactor run. (auth)

18987 (WANL-TME-1735) ERROR BAND LIMITS FOR WANL MEASUREMENTS ON NRX-A6. Moran, M. J.; Wolsko, T. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1968. 154p. Dep. NTIS $10.75.

Overall error band limits for the expected accuracies of all Westinghouse-supplied transducers used in the NRX-A6 test series have been calculated. The confidence level is near 99%. The transducer error band limits are calculated from data taken during the calibration of the instrument (NRX-A6 Calibration Data Book, WANL-TME-1453). The values for data system error refer to the static error. The data system and transducer accuracies have been treated as essentially independent; therefore, the overall error band limits are root-mean-square combinations of the two contributions mentioned above. The entire series of curves were plotted and prepared by the CDC-6600 Computer plus the CAL COMP plotter. A program called "UNCERT" was written for this task. Input to the computer includes the transducer calibration curve, the tolerance of the calibration curve, the data system accuracy, plus some labeling information. (auth)

18988 (WANL-TME-1758) FAST AND THERMAL NEUTRON FLUXES AND GAMMA DOSE RATES AT THE PAX PRESSURE VESSEL AND NOZZLE FLANGES. Rankin, W. D.; Kubancsek, G. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1968. 17p. Dep. NTIS $4.00.

Measurements have been made in the region of the nozzle-pressure vessel flange, and especially in the associated bolt holes, of the PAX-E4 reactor mockup. Fast and thermal neutron flux and gamma dose rate have been measured using passive detectors of sulfur pellets, dysprosium-aluminum foil, and thermoluminescent dosimeters. A table of results is presented showing the thermal and fast neutron flux and the gamma dose rate in the region of the nozzle and pressure vessel flanges and bolt holes. A few additional points corresponding to NRX-A5 dosimeter locations in the region of the nozzle throat, requested by Aerojet to provide a comparison with the A5 test, as well as data obtained during a fast fission chamber calibration are also reported. (auth)

18989 (WANL-TME-1759) FAST AND THERMAL NEUTRON FLUXES AND GAMMA DOSE RATES ON THE PAX DOME AND PRESSURE VESSEL. Rankin, W. D.; Kubancsek, G. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1968. 22p. Dep. NTIS $4.25.

Neutron flux and gamma dose rate measurements have been made on the dome and pressure vessel of the PAX mockup of the NRX-A6 reactor using passive detectors of sulfur pellets, Uranium-238 foils, dysprosium-aluminum foils and thermoluminescent dosimeters. The results are presented in tables. Selected portions are also presented in graphical format. The data tabulated comprise saturated activities of bare and cadmium-covered dysprosium and the resultant thermal neutron flux, saturated activities of sulfur and Uranium-238 and the resultant fast neutron fluxes above 2.9 and 1.4 MeV, respectively, and the gamma dose rate from TLD measurements. (auth)

18990 (WANL-TME-1771) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY ANNUAL OPERATIONS REPORT, 1967. Makovich, J. J.; Barksdale, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Apr 1968. 34p. Dep. NTIS $4.75.

During 1967, critical experiments were performed in support of the NRX-A6, XE-1 and XE-2 phases of the NERVA program on the PAX-EO, PAX-E1, PAX-E2, PAX-E3, PAX-E4, FCX and FCX-B assemblies. These are all high-power-density, graphite-moderated, beryllium-reflected reactors using fully enriched uranium-235 as fuel. The experiments included initial criticality, control drum worths, reactivity shimming, power distribution, reactivity coefficients of core and reflector materials, dosimetry measurements and reactor shutdown measurements. The occurrence of inadvertent reactor scrams (mostly resulting from noise transients actuating electronic trips) has been reduced by installing low-noise coaxial cables and a new coaxial patch panel. (LTW)

18991 (WANL-TME-1802) CRITICAL REVIEW OF REACTOR PHYSICS ANALYSIS METHODS FOR NERVA. Drawbaugh, D. W.; Gibson, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1968. 27p. Dep. NTIS $4.50.

The needs for better calculating methods, better experimental values of neutron spectra and spectrum averaged cross sections of isotopes occurring in the reactor, and for more effective ways of using the voluminous data required, are stressed. Emphasis is given to problems in getting reliable values for capture to fission ratio and for resonance cross sections in ^{235}U. Some data requirements for shielding calculations are discussed and the need for more accurate models of reactor geometry for control and transport calculations is treated briefly. (LTN)

18992 (WANL-TME-1834) CALIBRATION OF U^{238}(11 ppm U^{235}) FAST FISSION CHAMBERS (WX-30748) FOR NRX-A6 AND XE-PRIME. Oblock, V. S.; Obusek, E. J.; Magaw, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1969. 68p. Dep. NTIS $6.50.

Measurements with the PAX-4 and PAX-5 reactors were made to calibrate fission chambers, dosimeters, ion chambers, and thermoluminescent dosimeters for the purpose of measuring power levels in the NRX-A6 and XE-PRIME reactor tests. The results are given. (LTN)

18993 (WANL-TME-1882(Rev.1)) WANL INPUT TO NERVA PRELIMINARY CONTINGENCY PLANS FOR PROPOSED MISSIONS. Trammell, M. R.; Mikus, K. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Apr 1969. 111p. Dep. NTIS $8.75.

The NERVA Systems Safety program has two principal goals for flight operations of the nuclear rocket engine. First, it must be assured that inadvertent radiological hazards to the Earth's population be avoided. Secondly, safe return of the astronauts (in manned missions) following any system malfunction must be accomplished with the use of the disabled engine whenever feasible. Moreover, it appears desirable that the distribution of radioactive debris in space (particularly in those areas in which future operations are anticipated) be avoided. Implementation of these goals requires that the propulsion system design incorporate features that permit successful recovery of the astronauts and disposal of the engine. These features, then, can become design requirements on the system. The work described has been undertaken in order to identify and, where possible, to quantify these requirements. The approach taken has been to systematically examine all phases of five proposed missions to determine the best course of action to be followed should some disabling malfunction occur at any time during any of these missions. The aggregation of these emergency actions are "Contingency Plans" for these particular missions. The Contingency Plans will be further utilized in examining possible malfunctions in the propulsion system which require contingency action and assuring that requirements are stipulated to minimize these malfunctions. (auth)

18994 (WANL-TME-1890) NERVA CONFIGURATION MANAGEMENT PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1969. 60p. Dep. NTIS $6.00.

18995 (WANL-TME-1903) GUIDES FOR DYNAMIC HYBRID COMPUTATION AT THE WANL HYBRID COMPUTER FACILITY. Stock, A. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1969. 47p. Dep. NTIS $5.50.

Information required to use the WANL hybrid system for closed-loop applications is presented. Data are provided that permit the hybrid computer user to determine the feasibility of using hybrid computation in any specific application. Also provided are the programming mechanics required by a competent FORTRAN programmer to use the special purpose hybrid software. To date, the hybrid system, consisting of a Raytheon 520 digital computer and two EAI 231 R analog computers, has not been employed in any significant closed-loop applications. It is expected that closed-loop applications will now be feasible as a result of the hybrid software development as described. A closed-loop demonstration case is presented. With the development of this hybrid software, the system is capable of being used as a true hybrid computer. Additional software development is necessary before the full potential of the system can be realized. One major area where additional work is required is that of compensation techniques. (auth)

18996 (WANL-TME-1912) NUCLEAR SUBSYSTEM SHIELDING PROVISION STUDY EXPERIMENTS. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 450p. Dep. NTIS $25.50.

A series of experiments was performed with heterogeneous slab mockups of two types of R-1 internal shield designs considered for the Nuclear Subsystem Shielding Provision Study. These experiments in PAX-GOC provided information on the internal and external radiation environments for 69, 89, and 109 gm/cm^2 Boron Carbide-Aluminum-Titanium-Hydride (BATH) shields and for a 117 gm/cm^2 Borated Stainless Steel Liquid Hydrogen shield. Measurements were made to determine the shield mockup internal radiation environments using TLD and foil passive dosimetry to measure fast neutron fluxes, thermal neutron fluxes, and gamma ray-absorbed dose rates. Measurements of the external radiation environment were made with both active and passive dosimetry to determine fast neutron fluxes and dose rates, and gamma ray-absorbed dose rates. Test cell background for the external measurements was determined by similar measurements obtained on an auxiliary reactor shadow shield configuration. Direct leakage fluxes and dose rates outside the shield assemblies were thus obtained by subtraction of the test cell background to permit direct comparisons with analytical calculations. Analysis of the experiments was performed utilizing the WANL Integrated Nuclear, Radiation and Shielding Standard Design Method (WISDM). Both one-dimensional analysis with the ANISN-W discrete ordinates code and two-dimensional analysis with the DOT-IIW discrete ordinates code were performed to provide neutron and photon radiation levels internal to the shield mockups. In the neutron analysis, 16 group (11 fast and 5 thermal) P_0 transport-corrected cross sections were employed. In the photon problem, 13 group P_1 cross sections were utilized. An S_8 quadrature was employed throughout the analysis. Typically 8000 mesh cells were used to describe the reactor-shield geometry in the two-dimensional discrete ordinates analysis. This was accomplished by utilizing the boundary source option in the DOT-IIW code. Analytical results external to the experimental configurations were obtained both with the discrete ordinates and point kernel methods. The external discrete ordinates analysis was accomplished by the MAP code which utilizes as input the DOT-IIW surface angular leakage fluxes. Sources internal to the reactor-shield assemblies from the discrete ordinates method were used as input to the KAP-V point kernel code to calculate external fast neutron and photon environment. Extensive comparisons between the experimental data and the various types of calculations are presented and discussed. (auth)

18997 (WANL-TME-1927) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY ANNUAL OPERATIONS REPORT, 1968. Tobin, J. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1969. 20p. Dep. NTIS $4.00.

During 1968 critical experiments were performed on the PAX-E5 and FCX assemblies in support of the development phase of the NERVA program. These critical assemblies are beryllium-moderated, beryllium- or graphite-reflected reactors using fully enriched uranium-235 as fuel. The experiments involved shielding measurements and attempts to reduce wall-scattered radiation by the use of various wall-lining materials. Experiments involving initial criticality, control drum worths, reactivity shimming, power distribution, reactivity coefficients of core and reflector materials, dosimetry measurements and reactor shutdown measurements were also performed. Hazard and emergency analyses were made and, as a result, some regulations were modified to improve the safety of operations. Operator training was emphasized by lectures, simulated operation and a period of operation under supervision. (LTN)

18998 (WANL-TME-1984) CONTROL DRUM ACTUATOR. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1970. 416p. Dep. NTIS $24.00.

This trade study was conducted to select one control drum actuator candidate for development to meet program requirements. Four pneumatic-type proportional actuator candidates, seven electrical-type proportional actuators, and one pneumatic-type binary two-position actuator were considered. The comparison was made on five basic parameters: reliability, related system weight, related experience, performance, and safety. The selected concepts are: pneumatic, single piston rack and pinion; electric, permanent magnetic rotor electric stepper motor, and pneumatic, two positions. (auth)

18999 (WANL-TME-2703) PAX-G2 CONTROL DRUM SPANS. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. 39p. Dep. NTIS $5.00.

Control drum span measurements have been performed in support of the R-1 design on the PAX-G2A reactor, a nuclear mockup of an 18-drum R-1 design. Two different experimental procedures were employed, both of which yielded very nearly the same results. Comparison of analytical predictions with the experimental data yielded a drum span correction factor of 0.85, assuming a total delayed neutron fraction of 0.0070. This compares quite favorably to similar calculations for the PAX-G0B and PAX-G1A measurements of 0.89 and 0.86 respectively. Substantial drum interaction effects between the individual R-1 mockup drums were also demonstrated. (auth)

19000 (WANL-TME-2704) ANNUAL REPORT FOR CONTRACT YEAR 1969. Supporting Research and Technology, Project 493. Disney, R. K.; Jedruch, J.; Soltesz, R. G.; Kaiser, R. S.; Zeigler, S. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 154p. Dep. NTIS $10.75.

Advances in the methods for neutronic and radiation design of NERVA are described. The transport code DOT-IIW was improved in the acceleration of convergence, handling of boundary conditions and tape operations, and extensively tested for flux and eigenvalue convergence at different orders of quadrature and in r,θ geometry. Satellite codes for preparation of cross sections, and geometry were developed. Reduction of ray effects through Lagrangian interpolation in discrete ordinate fluxes was achieved. Improvements in two-dimensional perturbation code were made. (auth)

19001 (WANL-TME-2710) PROPOSED CY 1970 WORK PROGRAM MODIFICATIONS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Jun 1970. 189p. NTIS $12.50.

19002 (WANL-TME-2712) MATERIAL MANAGEMENT CONTROL. Worpell, R.; Hardy, W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1970. 31p. Dep. NTIS $4.75.

The requirements of a Material Control function are described: to provide the required quantity and quality of material needed at a required time at a designated place, with the minimum feasible investment over the life of the program. Material and hardware processing must be monitored and controlled to the lowest level of detail and continually updated. Ordering of parts, storage after receipt, etc. must be controlled and plans and schedules provided to management and functional departments, especially for critical items. The keystone of the process is a computerized status report known as the Material Management Control Report. (LTN)

19003 (WANL-TME-2717) PHASE 1-NSS PARAMETRIC PERFORMANCE EVALUATION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 13p. Dep. NTIS $4.00.

WANL Trade Study 716 established the recommended Nuclear SubSystem (NSS) performance parameters and estimated variations in these parameters at the rated operating condition and for build-to-build uncertainties. The results of Trade Study 710 were reexamined for the ten-hour full flow engine, the decrease in the nominal chamber temperature, and the chamber pressure derived from Trade Study 717. The present trade study documents the work done as of March 1, 1970. The nominal values and estimates of the 2.326σ variations in temperature rise and pressure drop for each NSS component were determined by a Monte Carlo analysis. The recommended NSS performance parameters and their estimated variations are given in tabular form. It is recommended that future revisions to the NSS performance uncertainties be obtained by a Monte Carlo Analysis of the NSS. This will require a representation of the engine components. (auth)

19004 (WANL-TME-2720) STARTUP, SHUTDOWN, AND THROTTLING. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 26p. Dep. NTIS $4.50.

WANL Trade Study 714 compared four throttling approaches with a no-throttling base case. After considering various functional and technical design considerations, primary and alternate throttling recommendations were made: perform fixed-drum throttling only within SSCV capabilities, accept a throttle point (variable) with reactor life or, if a fixed throttle point is required, add a valve to the pump discharge line to allow fixed-drum throttling. The startup portion of the study compared three high specific impulse startups with a middle of the map startup. Applying the same considerations as the throttling portion of the study, the middle of the map startup was recommended. The study recommended that shutdown should be performed without moving control drums, and the shutdown demand should follow a profile determined by the need to minimize cooldown propellant usage. The study also recommended the maximum chamber pressure ramp should not exceed 50 psi/sec, and the maximum chamber temperature ramp should not exceed 150°R/sec. (auth)

19005 (WANL-TME-2723) SHIELD ELEMENT CORROSION. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 32p. Dep. NTIS $4.75.

Specimens of BATH shield material were tested to determine their resistance to hydriding, dehydriding, nitriding, and contact corrosion with structural material when exposed to flowing hydrogen or nitrogen gas at a pressure of 600 psia and a temperature of 900°R for a period of two hours. Five specimens were tested in hydrogen and nitrogen gas. Two specimens were used for control. The specimens tested were in contact with 606 1-T6 aluminum at one end and with type 304 stainless steel at the other end. Test results indicate no corrosion or decomposition of the specimens or holders. There was no significant change in hydrogen or nitrogen content after a 2-hour exposure at the above conditions. Further, no surface spalling or debris generation of particles occurred greater than .007-inch. Based on these results, BATH shield development material in combination with 6061-T6 aluminum and Type 304 stainless steel should meet the thermal environment requirements. (auth)

19006 (WANL-TME-2724) LOBO: A COMPUTER PROGRAM TO AZIMUTHALLY MESH (FROM AN EXTERNAL ORIGIN) AND APPROXIMATE CIRCLES, ANNULI, AND PARTIAL ANNULI. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. 46p. Dep. NTIS $5.50.

A computer code is described which approximates, by means of azimuthal mesh cells circles, annuli and angular portions of annuli. The output can be used in computer codes which predict neutron fluxes. (auth)

19007 (WANL-TME-2726(Vol.1)) NERVA MANAGEMENT PLAN: VOLUME 1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1970. 108p. Dep. NTIS $8.50.

The Management Plan describes the Westinghouse system for managing the design, development, qualification and delivery of NERVA Nuclear Subsystem. This Plan contains a functional analysis of the tasks to be performed and identifies the methods for performing these tasks. Responsibility for accomplishing the work is assigned to the various operational disciplines, and the disciplines are then related to the actual WANL organizational structure. (auth)

19008 (WANL-TME-2726(Vol.2)) NERVA MANAGEMENT PLAN. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1970. 357p. Dep. NTIS $21.00.

A series of responsibility matrices relating the organizations and disciplines described in Volume I to the functions and documents depicted on the functional flow diagrams presented in Volume III are presented. (auth)

19009 (WANL-TME-2739) REACTOR SERIES GROUND TEST PROGRAM FUNCTIONAL FLOW DIAGRAMS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 13p. Dep. NTIS $4.00.

19010 (WANL-TME-2740) REACTOR SERIES GROUND TEST PROGRAM REQUIREMENTS ALLOCATION SHEETS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 218p. Dep. NTIS $14.00.

The functions which must be performed to successfully complete the Reactor Test Series of the NERVA program are described. In addition, the Test Article design and Test Support Equipment (TSE) requirements are explained in detail. (auth)

19011 (WANL-TME-2748) NERVA REACTOR TEST CELL 'C' FACILITY COMPATIBILITY SAFETY REPORT. Skaritka, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 42p. Dep. NTIS $5.25.

The safety aspects of conducting the NERVA reactor development and qualification tests at Test Cell "C" are evaluated. The known differences between the R-series and previous NRX test systems (including facilities) are compared for the purpose of uncovering new or significantly increased hazards associated with the test program. Safety problem areas are identified which will require detailed analyses before conducting the R-series test program. After considering the basic differences between the R-series and NRX-type test systems, it has been concluded that R-testing can be safely conducted when the proper system safeguards and procedural controls are implemented. It is also concluded that compared to previous NRX/XE testing, the safety constraints that must be incorporated into the program will be greater for R-testing due to its greater sensitivity to reactivity addition by hydrogen, a decreased control drum shutdown margin, and a substantial increase in fission product release due to a change to composite fuel. Although the safety constraints will be more limiting, procedural controls and/or equipment safeguards are not expected to be significantly different for R-testing than those used for previous NRX/XE testing. (auth)

19012 (WANL-TME-2755) DYNAMIC ANALYSIS REPORT, NUCLEAR SUBSYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1971. 149p. Dep. NTIS $10.50.

Dynamic modal analyses of the Pressure Vessel and Reactor Assembly are used as a basis for the derivation and establishment of dynamic design and performance requirements for the Nuclear Subsystem and its Engineering Critical Components. They provide a source for the calculation of loads and stresses caused by dynamic and acoustic environments. A summary of the applicable specifications relevant to the structural dynamic design, a description and derivation of analytical models and methods, the maturity of the input data, the validity of the analytical methods, and the interpretation and analysis of the resulting natural frequencies and mode shapes are presented. (auth)

19013 (WANL-TME-2756) LOADS ANALYSIS REPORT, NUCLEAR SUBSYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 387p. Dep. NTIS $22.50.

The primary structural loads to which the NERVA engine and its major components are subjected during launch and nuclear stage operation are identified and estimated. This basic loads report is a working document to assist all structural analysis, design and testing efforts in achieving a high level of structural efficiency, performance and reliability. The analysis will be subject to continuing revision and updating during the design and development phase. (auth)

19014 (WANL-TME-2778) ANNUAL REPORT FOR CONTRACT YEAR 1970. Supporting Research and Technology. Project 493. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 139p. Dep. NTIS $10.00.

A developmental work in mathematical methods carried out in support of the design of the NERVA reactor is described. The improvements in the transport theory codes: ANISN-W, DOT-IIW and MAP are described in detail through the relevant equations, the results of test problems, and comparisons of results to experimental measurements. Improvements in eigenvalue convergence using upscatter scaling in energy, new finite difference formulations, inclusion of zonal balance summary, and angular interpolation techniques in discrete ordinate solutions are treated. Incorporation of the diffusion theory solution in DOT-IIW is described, and the feasibility of using the adjoint kernel technique in coupling through voids is investigated. (auth)

19015 (WANL-TME-2785) WORK PROGRAM, OCTOBER 1, 1970–SEPTEMBER 30, 1972. NERVA Nuclear Subsystem. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Apr 1971. 103p. Dep. NTIS $8.25.

Research development, test and work tasks of the NERVA program are described in detail. (LTN)

19016 (WANL-TME-2786) PROJECT PLANNING AND SCHEDULE DATA, MARCH 1, 1971–SEPTEMBER 30, 1972. NERVA Nuclear Subsystem. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Apr 1971. 57p. Dep. NTIS $6.00.

19017 (WANL-TNR-088(Rev.D-1)) PRODUCT ASSURANCE PROGRAM PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Apr 1967. 45p. Dep. NTIS $5.25.

Westinghouse's contractual responsibilities in the areas of safety and reliability in the NERVA program are used as a base for planning a quality assurance program based on good design and a quality control program designed to maintain design quality. Organizational responsibilities, procedures, etc. are defined. (LTN)

19018 (WANL-TNR-113) NRX-A1 COLD FLOW OPERATIONAL SUPPORT PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Jun 1963. 51p. Dep. NTIS $5.75.

The purpose of the Cold Flow program is to perform a nonnuclear flow test for testing current reactor design and establishing new criteria for subsequent NERVA NRX reactors. The functional operations that must be performed for the NRX Cold Flow program and the equipment required for each operation are presented in chronological sequence. Included are all operations required to support: the pressure vessel, closure and nozzle assembly packaging and shipping facilities at AGC-LRP Sacramento, California; the cold flow reactor subsystem assembly packaging and shipping facilities at WANL, Large, Pennsylvania; the integration of the pressure-vessel-nozzle subsystem with the cold flow reactor system to form the NRX Cold Flow Assembly at NRDS; the preparation for testing, testing and post-operative examinations; and the preparation for shipment of all NRX Cold Flow parts after test and examinations from NRDS. (auth)

19019 (WANL-TNR-144) NRX BLOCK I OPERATIONAL SUPPORT PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Jan 1964. 147p. Dep. NTIS $10.50.

This operational support plan of Block 1 tests (NRX-A2, NRX-A3, NRX-A4) presents in chronological sequence the functional operations that must be performed to complete each step of an individual reactor test and categorically lists the equipment required to accomplish each operation. Included are the operations and support equipment required in the packaging and shipment of the non-nuclear components, the packaging and shipment of the nuclear reactor assembly, the receiving of components, integration of components, preparation for testing, hot disassembly and post-operative examinations at the Nuclear Rocket Development Station (NRDS) at Jackass Flats, Nevada and the post-operative examinations at other facilities. (auth)

19020 (WANL-TNR-175) NERVA PROGRAM NRX-A4 TEST PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1964. 37p. Dep. NTIS $5.00.

The overall objective for the NRX-A4 reactor test is to operate at full power for a total time of 30 minutes, to start up and shut down from various conditions, and evaluate the structural integrity and nuclear and control system performance. Twenty-two specific test plans are described. Many of these will be performed before the full power test and involve calibration, flow testing, etc. to ensure that the instrumentation and control systems are adequate for full power testing. (LTN)

19021 (WANL-TNR-196) NRX/EST TEST PLAN. (Aerojet-General Corp., Sacramento, Calif. (USA); Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1965. 36p. (RN-S-0175). Dep. NTIS $5.00.

The NRX/EST Test is the first hot-bleed cycle nuclear rocket engine systems test. It will be performed at Test Cell "A" using an NRX-A reactor subsystem and a NERVA propellant feed system installed on a basic NRX-A test car which has been modified. The principal objective is to demonstrate the feasibility of the hot-bleed cycle nuclear engine. These tests will confirm that the system can be started by use of the stored heat within the engine. The NRX/EST serves as a bridge between the NRX-A test series which were performed primarily to demonstrate the adequacy of the NERVA reactor concept, and the X-Engine tests, to be performed in ETS-1 starting in calendar year 1966. The analytical programs for NRX/EST utilize both analog and digital computational techniques, and will be augmented by the Cold Flow Development Test System (CFDTS) which will precede the NRX/EST tests. The CFDTS consists basically of a NERVA XE-1 rocket engine with an unfueled reactor assembly, and a multistage ejector system to effect backpressure control. The initial CFDTS tests will partially simulate NRX/EST conditions (i.e., wet pump start, backpressure at NRDS ambient conditions, etc.). The tests will be run with various tank pressures and turbine power control valve programs. The engine analytical models will be upgraded by use of data from this test program. (auth)

19022 (WANL-TNR-204) NERVA PROGRAM NRX-A5 TEST SPECIFICATION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1966. 126p. Dep. NTIS $9.50.

The goals and objectives of the NRX-A5 test series are presented, along with detailed operational procedures involving specifications, inspections, assembly and disassembly operations, specific operational tests, etc. The overall objectives are to operate the reactor at design conditions for a total of 40 minutes and to investigate new control concepts, particularly with respect to startup and shutdown. The aim is to develop simple control methods, automatic control methods and methods which might permit operational control with malfunctions of some equipment. Many more specific objectives, plans and procedures are given in detail. (LTN)

19023 (WANL-TNR-214) NRX-A6 OPERATIONAL SUPPORT PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 May 1966. 121p. Dep. NTIS $9.25.

The NRX-A6 Operational Support Plan presents the basic requirements of the test program and defines the Ground Support System which satisfies these requirements. This document contains four sections: Introduction, functional Flow Diagrams, support System Functional Analysis, and pictorial Flow Diagrams. The purpose and intent of the support plan is described. Flow Diagrams present in schematic form the various activities associated with the test program. Functional Analysis details the requirements of each functional activity and presents solutions to the stated requirements. Pictorial Flow Diagrams illustrate the solutions in pictorial form. (auth)

19024 (WANL-TNR-215) NERVA PROGRAM NRX-A6 TEST SPECIFICATION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1966. 134p. Dep. NTIS $9.75.

The objectives, goals and plans of the NRX-A6 reactor test are presented. The objective is to operate the reactor at rated power for 60 minutes or to a predetermined loss of reactivity. The reactor control system (which contains some new modifications) will be evaluated, the performance of the flow system will be studied with respect to both thermal and fluid flows. The nuclear performance will be determined (especially with respect to experimental fuel element durability under full power conditions) and finally extensive data on support and redesigned systems will be collected by a variety of instrumentation and past operative examination. Many more specific tests are described in detail. (LTN)

19025 (WASH-1164) SELECTED TFE DEVELOPMENT ACTIVITIES STATUS REPORT. (General Electric Co., Pleasanton, Calif. (USA). Nuclear Thermionic Power Operation). Aug 1970. Contract AT(04-3)-771. 256p. Dep. NTIS $16.00.

A detailed description of the current thermionic fuel element design is presented and a discussion of key thermionic fuel element development issues follows. In the discussion of development issues, key problems which are currently recognized have been presented and development approaches to their resolution have been suggested. A selection of experimental development tasks are included. The first of these is a brief summary of post-test observations on emitters which emphasizes fuel and clad structures in the post-test conditions. This discussion is followed by a description of trilayer heat transfer test results and the experimental results from a series of out-of-pile sheath/insulator arcing tests. The preliminary results from an in-pile arcing test are also presented. A discussion of the results of an emitter/collector shock and vibration test is included. A series of design analysis studies are presented. The first of these is an analytical study of trilayer heat transfer which was conducted in parallel with the trilayer heat transfer tests. A discussion of sheath insulation arcing phenomena and the nature of the development problems associated with such arcing events are discussed. A discussion of crack behavior in the slip-fit trilayer concept which was carried out in order to determine the dependence of crack width on temperature and heat flux conditions is included. An extensive series of heat transfer and elastic thermal stress calculations for the emitter body are presented. These have been carried out in order to determine the temperature conditions and to determine the dependence of these temperatures on modifications in the emitter and fuel design. Elastic thermal stress calculations have been carried out in parallel with the heat transfer calculations. (21 references) (auth)

19026 FRONTIERS OF POWER TECHNOLOGY. Proceedings of a Conference Held at Stillwater, Oklahoma, October 23–24, 1969. Stillwater, OK; University of Oklahoma (1969). vp. (CONF-691077-).

A separate abstract is included for one of the 20 papers presented on power technology. The other 19 papers included discussions on electric power utilization, electric power transmission, MHD generators, and fuel cells. (DCC)

For an abstract of an individual paper see: 19027.

19027 COMMENTS ON THE FEASIBILITY OF DEVELOPING GAS CORE NUCLEAR REACTORS. Rom, F. E. (Lewis Research Center, Cleveland). pp 5.1–5.38 of Frontiers of Power Technology. Stillwater, OK; Univ. of Oklahoma (1969).

From frontiers of power technology conference; Stillwater, Oklahoma, USA (23 Oct 1969). See CONF-691077-.

Recent developments in the fields of gas core hydrodynamics, heat transfer, and neutronics indicate that gas core nuclear rockets may be feasible from the point of view of basic principles. Specific impulse is expected to be in the range of 1500 to 2500 seconds for thrust levels of the order of 100,000 to 1,000,000 pounds of thrust and powerplant weights in the range of 100,000 to 300,000 pounds. The ratio of hydrogen to uranium mass flow rates may be of the order of 100 to 1. Based on performance predictions using these results, mission analyses indicate that gas cores have the potential for reducing the initial weight in orbit of manned interplanetary vehicles by a factor of 5 when compared to the best chemical rocket systems. In addition, there is a potential for reducing total trip times from 450 to 500 days for chemical systems to 250 to 300 days for gas core systems. Calculations show that there is no pollution or radiation hazard produced by the release of all the fission products and unfissioned uranium from gas cores into space. (78 references) (auth)

Reactor Safety and Environmental Aspects

Refer also to abstracts 16523, 16528, 16552, 16556–16559, and 16561.

19028 (ANCR-1164) SEMISCALE PRESSURE SUPPRESSION SYSTEM PERFORMANCE DURING THE ISOTHERMAL BLOWDOWN TEST SERIES. Livingston, R. A. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Nov 1974. Contract AT(10-1)-1375. 71p. Dep. NTIS $5.45.

Test results relating to the performance of the pressure suppression system used for the semiscale isothermal blowdown test series are analyzed. The semiscale test system is a nonnuclear, subscale representation of a four-loop pressurized water reactor and is used for blowdown tests pertinent to water reactor safety analysis. The pressure suppression system in the subject test series provides modeled PWR containment pressure response for the blowdown experiments which simulate loss-of-coolant accident conditions. (auth)

19029 (ANCR-1171) APPLICATION OF A REAL TIME STACK MONITOR USING A Ge(Li) DETECTOR AND A PDP-9 PROCESSOR. Nieschmidt, E. B.; Dyer, N. C.; Killian, E. W.; Coates, R. A. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Nov 1974. Contract AT(10-1)-1375. 24p. Dep. NTIS $4.00.

The growing number of nuclear reactors used for power generation has increased the need for rapid isotopic analysis of reactor system effluents. Described here is a prototype stack monitor recently operated at the Advanced Test Reactor at the Idaho National Engineering Laboratory. This remotely operated system uses a 45 cm^3 Ge(Li) detector and a 4096 channel multichannel analyzer; data are processed by a PDP-9 computer. Data transmission and analyzer control is via commercial telephone and MODEM system. During a recent two-week operating cycle the stack effluent was monitored. The more prominent isotopes observed include ^{88}Kr, ^{89}Kr, ^{89}Rb, ^{135}Xe and ^{138}Xe; numerous other isotopes were identified and quantified. The results of this monitoring, interpretation of the data and system operation will be discussed. 5 references. (auth)

19030 (ANL-8120) CHEMICAL ENGINEERING DIVISION REACTOR SAFETY AND PHYSICAL PROPERTY STUDIES ANNUAL REPORT, JULY 1973–JUNE 1974. Chasanov, M. G.; Fischer, D. F.; Fredrickson, D. R.; Gabelnick, S. D.; Kumar, R.; Leibowitz, L.; Reedy, G. T.; Cafasso, F. A.; Burris, L. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-eng-38. 113p. AT.

A report of the work on reactor safety and physical property studies is given for the period July 1973–June 1974. The report includes the following: results on the study of the behavior of irradiated fuel under power-transient simulation using direct electrical heating; information on the development of equipment to measure the electrical resistivity of mixed-oxide fuel materials; determination of the enthalpy of Cs_2MoO_4 by drop calorimetry; calculations of high-temperature thermophysical properties of sodium from various estimates of critical parameters; a progress report on studies aimed at the determination of the thermal diffusivity of molten UO_2; measurements on the solubility of UO_2 in molten basalt and the viscosity of such solutions; results of an investigation of the interaction of basalt with molten sodium at ~900°C; and analysis of the effects of sacrificial barrier materials on the post-accident heat-removal requirements following a hypothetical core-disruptive accident. (auth)

19031 (ANL-8143) CALCULATION OF TRANSIENT FISSION-GAS RELEASE FROM OXIDE FUELS. Gruber, E. E. (Argonne National Lab., Ill. (USA)). Nov 1974. Contract W-31-109-eng-38. 22p. Dep. NTIS $4.00.

A model to analyze transient release of fission gas from oxide fuel has been developed. The model is based on the assumption that, because of porosity link-up effects at grain-boundary intersections, the rate-controlling step in gas release is migration to the boundaries. The gas is assumed to be present initially in the form of extremely small intragranular bubbles in the unrestructured fuel. Steady-state gas release is rapid in restructured fuel, but is too slow in unrestructured fuel to overcome the re-solution rate, which dominates at lower temperatures. Gas release is analyzed in the framework of a model for bubble migration and coalescence, which calculates the statistical distribution of intragranular bubble sizes as a function of time from the transient history. The fuel grains are approximated as spheres, from which the gas can escape by either biased or random migration. The rate of release is determined from mean values of bubble mobility and velocity, which depend on the coalescence calculations as well as on the thermal conditions. The model is applied to two transient tests of irradiated fuel, the H3 TREAT failure-threshold transient and the FGR-15 out-of-pile transient simulation. It is assumed that bubble migration occurred by the surface-diffusion mechanism; good agreement with the test results is obtained by determining an appropriate surface-diffusion coefficient. Calculations are reported for a hypothetical loss-of-flow transient. Effects of variations in heating rate, thermal gradient, burnup, and grain size are shown by the calculated results. (auth)

19032 (CONF-701074-P1, pp 82–98) CONCEPTION OF RADIATION SAFETY IN ATOMIC ELECTRIC POWER PLANTS. Gladki, E.; Koptz, I.; Moravek, I.; Melikhar, Z.; Kapishovskii, V. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The accurate estimation of the concept "radiation safety of nuclear power stations" is discussed in detail. The basic philosophy of radiation safety and the methods of approaching its solution based on the type of reactor, its design and location are discussed. The main problems are pointed out and evaluation is made about their role in the general decision on the question of radiation safety of nuclear power stations. The formulation of the general concept of radiation safety is presented, indicating characteristic features of its solution and corresponding analysis for different types of nuclear power stations. (auth)

19033 (CONF-701074-P1, pp 198–221) INFLUENCE OF VARIOUS ENGINEERING-TECHNICAL SAFETY DEVICES OF ATOMIC ELECTRIC POWER PLANTS WITH WATER COOLED REACTORS ON THE RELEASE OF RADIOACTIVITY AND ITS DISCHARGE INTO THE ATMOSPHERE. Burkhard, V.; Shimmel, V.; Aikhgorn, K. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Radiation by the radioactive discharge from nuclear plants within the territory of this country result mainly from the normal working systems as well as discharges that occur, although very rarely, from unforeseen occurrences and catastrophes, the possibility of which are not altogether excluded (for example, failure to respond by all safety and preventative systems or by forced action). On the whole, the mean yearly quantity of discharge during accidents or unforeseen occurrences should not exceed the total quantity of discharge under normal conditions. Tests were carried out to determine the influence of separate components of atomic electric power plant, for example circuit, reactor safety cooling etc., for radiational risks. The results and conclusions of these analyses are given. (5 references) (auth)

19034 (CONF-701074-P1, pp 241-262) SAFETY OF ATOMIC ELECTRIC POWER PLANTS WITH VVER TYPE REACTOR. Ostashenko, V. F.; Bumbli, I. I.; Alpatov, A. M. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

When planning an atomic electric power plant with a VVER reactor, the question of safety is very important. The general aspects of safety, which must be taken into consideration in planning, are discussed in detail and include the following: physical characteristics of the core of a reactor; thermal and hydraulic characteristics of the reactor's core; system of control and reactor protection; possible accident situations, connected with measurements of reactance; and possible accident situations, connected with the breakdown of the mechanical equipment. (auth)

19035 (CONF-701074-P1, pp 263-275) HYPOTHETICAL ACCIDENT AT AN ATOMIC ELECTRIC POWER PLANT EQUIPPED WITH A VESSEL REACTOR. Dement'ev, B. A.; Kuznetsov, V. D. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The article presents the results of an investigation of the consequences of an accident connected with hypothetical rupture of the circulation loop at an atomic electric power plant equipped with a vessel reactor. Analytical models are examined which permit obtaining unexpected information for subsequent analysis of the radiation situation after the accident: change of pressure in the primary circuit and the reactor rooms, the temperature conditions of the fuel elements, and the character of destruction of the core in the course of time. Certain distinctive features of the course of such an accident are reviewed. In conclusion, certain results are cited which were obtained in an experimental investigation of accidents of a similar type conducted on a model, which confirm the applicability of the approaches used for analysis of the consequences of such accidents. The results of the work can be used in the evaluation of the consequences of a hypothetical accident in the primary circuit of an atomic electric power plant equipped with a water-moderated water-cooled power reactor. (auth)

19036 (CONF-701074-P1, pp 276-295) ANALYSIS OF ACCIDENTS IN THE PRIMARY CIRCUIT OF AN ATOMIC ELECTRIC POWER PLANT WITH WATER-MODERATED WATER-COOLED REACTORS DURING PIPE RUPTURES. Mal'tsev, B. K.; Khlestkin, D. A.; Rzheznikov, Yu. V.; Stavritskaya, L. V.; Kanishchev, V. P.; Indurskii, M. S. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

An analysis is made of accidents connected with the development of looseness in elements of the primary circuit of an atomic electric power plant with water-moderated water-cooled reactors. Data are presented which generalize experimental investigations to determine the critical hot-water flow rates. On the basis of a multiregional model of the primary circuit, equations of energy and mass conservation and an equation of state are given which permit determining the character of the change of the coolant parameters when a leak forms. Presented as an example is the calculation of the change of pressure, flow rate and mass level in the equipment when there is a rupture of the main circulation pipeline of a Dy-500 vessel-type reactor. A comparison is made with data obtained in the United States. (9 references) (auth)

19037 (CONF-701074-P1, pp 319-339) ASPECTS OF RADIATION SAFETY WHEN PLANNING AND EXPLOITING CHANNEL TYPE POWER REACTORS. Veselkin, A. P.; Beskrestnov, P. V.; Sklyarov, V. P.; Khandamirov, U. E.; Yashnikov, A. I. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Tendencies in development of systems securing radiation safety of atomic electric power plant with uranium graphite reactor channel-type are discussed. Some peculiarities and advantages of an atomic electric power plant with reactors of this type are set forth, as compared to reactors of other types. The principles of constructive decisions, specifically the biological shielding of atomic electric power plants are examined, as well as other systems that increase the radiation safety. Data regarding the radiation conditions that are discussed were obtained from results of operation of Beloyarsk Atomic Electric Power Plant. (22 references) (auth)

19038 (CONF-701074-P1, pp 535-560) COMPUTATIONAL METHODS OF EVALUATING THE EMERGENCY STATE OF A SODIUM LOOP DURING PIPING BREAKDOWN IN A "SODIUM-WATER" STEAM GENERATOR. Poplavskii, V. M.; Bagdasarov, Yu. E.; Leonchuk, V. N. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Presented are computational methods for evaluating the effects of the reaction of sodium with water directly in the reaction zone, and also on various sections of the sodium loop during considerable destruction of heat-transfer pipes in a steam generator. A description is given of a physical model of the process used to construct computational procedures. The maximum possible emergency pressures and temperatures in a steam generator directly in the reaction zone are analyzed, and a method of calculating the change of parameters of the reaction in the course of time in the zone of pipe destruction with consideration of the compressibility of the coolant is presented. Methods are presented for calculation of hydrodynamic effects in the sodium loop of the installation and the emergency systems of the steam generator. Simplified methods of calculating the emergency parameters are explained, the use of which is convenient in the stage of rough determination of the main characteristics of the liquid metal system. (11 references) (auth)

19039 (EIR-264) PRESENT SWISS ACTIVITIES IN THE FIELD OF REACTOR NOISE ANALYSIS. Seifritz, W. (comp.). (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland); Ecole Polytechnique, Lausanne (Switzerland). Lab. de Genie Atomique). Sep 1974. 92p. (CONF-741065-43). Dep. NTIS (US Sales Only) $7.75.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Seven papers on details of Swiss reactor technology are presented, dealing with coupled reactors, neutron generating time, heat transfer, temperature and neutron flux fluctuations, reactor noise, thermocouples (fast response for sodium coolants), subcritical reactivity measurements and correlations of environmental influences on radioactive argon releases from plumes of reactor stacks. Theoretical modeling studies of reactor noise suggest that coolant boiling increases the power fluctuations at a certain frequency range and a peak occurs near 1 Hz (dependent on the void coefficient); feedback of void reduces power fluctuations below 10^2 Hz and is negligible above 10 Hz. In the case of argon releases from reactor stack plumes, there is a direct proportionality between the gamma dose rate, measured at ground level, and the cosine wind direction, and a reciprocal proportionality between the gamma dose rate and the wind speed. The effect of a vertical temperature gradient (inversion) on the dose rate can be neglected. No efforts were made to apply Thie's method for separating the natural background radiation from the plant-induced radiation because the latter was considerably higher than the former. (LTW)

19040 (GEAP-10207-31) REACTOR PRIMARY COOLANT SYSTEM PIPE RUPTURE STUDY. Progress Report No. 31, January–June 1974. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Sep 1974. Contract AT(04-3)-189. 23p. Dep. NTIS $4.00.

The pipe rupture study is designed to extend the understanding of failure-causing mechanisms and to provide improved capability for evaluating reactor piping systems to minimize the probability of failures. Following a detailed review to determine the effort most needed to improve nuclear system piping (Phase I), analytical and experimental efforts (Phase II) were started in 1965. This progress report summarizes the recent accomplishments of a broad program in (a) fatigue studies through bench-scale tests, (b) at-reactor tests of the effect of primary coolant environment on the fatigue behavior of piping steels, and (c) failure probability study of actual reactor piping systems. (auth)

19041 (GEAP-13317-08) BWR BLOWDOWN HEAT TRANSFER EIGHTH QUARTERLY PROGRESS REPORT, APRIL 1–JUNE 30, 1974. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Jul 1974. Contract AT(04-3)-189. 31p. Dep. NTIS $4.00.

Two-Loop Test Apparatus (TLTA) startup testing has been completed. The first two 49-rod Blowdown Heat Transfer (BDHT) matrix tests have been executed and some preliminary data are presented. A measurement problem was detected and corrected. Updated pretest predictions for the reference test are presented. An alternate lower plenum and a backup system to the sliding electrical contacts have been designed. The Task B topical report has been completed and submitted to the U.S. AEC for patent review. 14 references. (auth)

19042 (GEAP-13923-8) SAFETY ENGINEERING (BASE DEVELOPMENT PROGRAM). Eighth Quarterly Report, May–July 1974. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Sep 1974. Contract AT(04-3)-893. 20p. AT.

Information is presented concerning the comparison of BEHAVE-3 and THTE computer code analyses of LMFBR fuel and cladding temperature distributions under accident conditions. 5 references. (DCC)

19043 (HEDL-TME-74-54) SCALE-UP OF TEST RESULTS FROM SIMULATION EXPERIMENTS OF A HYPOTHETICAL CORE DISRUPTIVE ACCIDENT IN THE FAST FLUX TEST FACILITY. Fox, G. L.; Stepnewski, D. D.; Polentz, L. M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1974. Contract AT(45-1)-2170. 108p. AT.

The scale-up process and application of test results obtained from scale models of the FFTF reactor vessel and piping subjected to a simulated hypothetical core disruptive accident (HCDA) are described. The Buckingham Pi Theorem is used to identify material and process parameter relationships between model and prototype required for exact similitude. Departures from similitude requirements in the scale model tests are identified, and the effects of these departures on full-scale vessel response are assessed. Correction factors are developed for scaling the timing of dynamic loading events and peak impact forces. Strain values observed in the model tests are corrected for nonprototypicalities and scaled to a full-size reactor system. After the application of correction factors, the strain distribution pattern in a full-scale system is shown to remain similar to those which occurred in the tests. Using the conclusions developed in the analytical scale-up process, post-test observations on the vessel and pipe model are interpreted in terms of full-scale equipment. It was concluded that the primary coolant boundary would maintain its integrity under load conditions of a 150 MW-sec HCDA. No behavior was observed in the tests which could be interpreted as preventing in-vessel post-accident heat removal. (auth)

19044 (KFK-1989) NUCLEAR AEROSOLS IN A CLOSED SYSTEM. Jordan, H.; Schikarski, W.; Wild, H. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik). Oct 1974. 100p. (In German). Dep. NTIS (US Sales Only) $8.00.

This report is the final report on the AV (aerosol behavior) program that was terminated as a first phase in 1973. Its principal aim is a complete and detailed compilation of all relevant experimental and theoretical results of the program. The AV program was set up to investigate the behavior of UO_2 aerosols in a dry, inert and enclosed atmosphere. Such a system is brought into the context of Fast Breeder Reactor safety in the introduction and conclusion of this report where the primary role of the fuel aerosol in the event of a hypothetical LMFBR accident is emphasized. The result of the program is a basic understanding of the aerosol-mechanical processes that determine the dynamics of an aerosol system. These are incorporated in a computer code that satisfactorily duplicates experimental findings and that can be used to extrapolate these to actual reactor containment situations. Parameters of major influence on the half-life of suspended fuel mass have been identified. These are the physical dimensions of the system, its temperature and rate of heat loss and the type and initial size distribution of the aerosol particles. The remaining uncertainties in the influence of type and size distribution of the aerosol particles are discussed. 49 references. (auth)

19045 (ORNL-TM-4729(Vol.3)) QUARTERLY PROGRESS REPORT ON REACTOR SAFETY PROGRAMS SPONSORED BY THE DIVISION OF REACTOR SAFETY RESEARCH FOR JULY–SEPTEMBER 1974. III. Liquid-metal-cooled Fast Breeder Reactor Safety. Fontana, M. H.; Kress, T. S. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 28p. Dep. NTIS $4.00.

Progress in the investigation of the release of transuranic elements and fission products resulting from an LMFBR hypothetical core disruptive accident is reported. (DG)

19046 (RN-DR-0126) OVERRIDES AND MALFUNCTION PROTECTION FOR THE XE-1 ENGINE. Openshaw, F. L. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1967. 67p. Dep. NTIS $6.50.

Override and malfunction protection systems for the XE-1 Reactor (provided in addition to the SCRAM and flow shutdown systems) are described. These systems will provide a high probability of continued operation and, in combination with the engine safety system, provide maximum protection of the engine. These systems (1) prohibit the selection of dangerous modes of operation if pressure, temperature or power errors are large and (2) reduce pressure demand and either temperature or power demand if the measured pressure becomes greater than 60 psia less than the demand value, and (3) provide override protection based on control drum position or temperature. The intent is to provide redundant safety paths and protection against multiple malfunctions. (LTN)

19047 (SAND-74-5379) HUMAN RELIABILITY ANALYSIS APPLIED TO NUCLEAR POWER. Swain, A. D.; Guttmann, H. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 6p. (CONF-750108-2). Dep. NTIS $4.00.

From annual reliability and maintainability symposium; Washington, District of Columbia, USA (28 Jan 1975).

The Sandia Laboratories method of evaluating human reliability is called THERP (Technique for Human Error Rate Prediction). It is a method, in continuous use since 1962, for predicting human error rates (or other estimates of human performance) and for evaluating the degradation to a man-machine system likely to be caused by human performance in association with equipment functioning, operational procedures and practices, and other system and human characteristics which influence system behavior. (auth)

19048 (SFB-MHD-9) STABILITY OF NOZZLE FLOW AND BOILING PATTERN IN NOZZLES. Fujiie, Y. (Technische Univ. Berlin (F.R. Germany). Sonderforschungsbereich Magnetohydrodynamik). Dec 1972. 64p. Dep. NTIS (US Sales Only) $6.25.

To avoid the initiation of boiling in the convergent section of the nozzle, and also to minimize the mass flow rate perturbation, a treatment is performed concerning the effectiveness of a pressure fluctuation absorber being provided in the nozzle. The results show that the ratio of the mass flow perturbation with and without absorber becomes as small as 0.01 for the nozzle here analyzed. The boiling process in the nozzle is also discussed. The vapor bubble originated by the boiling initiation might not occupy the whole cross section of the nozzle before it transits from the point of the boiling initiation to the throat and therefore the single bubble ejection process is not the expected boiling pattern for the nozzle here employed. 7 references. (auth)

19049 (WANL-MP-006) WESTINGHOUSE CAPABILITIES IN NUCLEAR FLIGHT SAFETY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 12p. Dep. NTIS $4.00.

Safeguards engineering studies of hazards connected with ground testing or flight use of NERVA reactors are treated briefly. The capabilities of Westinghouse personnel in computer calculations, radiochemical analyses, and theoretical and experimental study of complex systems, hazards, etc. are described. (LTN)

19050 (WANL-TME-1172) STATUS REPORT ON FLEXIBLE POISON WIRE DEVELOPMENT. Parker, G. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1965. 50p. Dep. NTIS $5.50.

The requirements and developmental status of an Anticriticality Poison Wire System to provide guaranteed shutdown of the reactor under environmental conditions and such credible accident situations as fire, explosion and water immersion (as might occur in launching or launch failure) are described. The system involves about 3000 wires of neutron absorbing material which are inserted into the core coolant channels. The wires must be reasonably flexible to facilitate removal from peripheral areas through the reactor nozzle after launch. They are 0.06–0.085 inch diameter and 54 inches long. The poison must be doubly encapsulated in the wires to prevent loss in the reactor and the wires must be sufficiently strong to avoid damage during insertion or removal or launch. After a considerable investigation, enriched Boron-10 was chosen as the poison and used as the carbide (b_4C), which is not soluble in water and has a very high temperature stability. Through the use of fabrication and sintering techniques, the density of the material was increased to 80–90 percent of theoretical, so that 3000 wires made with such material would be sufficient. The encapsulation was carried out by encasing the boron carbide rods made as above with fiberglass or metallic braid and coating this with Teflon (the latter process was repeated 3 times). This produced a strong, light, flexible wire with good chemical and temperature stability and a desirable low coefficient of friction. Various other technical details and a proposed manufacturing process are discussed. (LTN)

19051 (WANL-TME-1422(Add.4)) OPERATIONAL MANUAL FOR REACTOR SAFETY SYSTEM REVISIONS XE-1(ETS-1). Kowalcheck, H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1968. 47p. Dep. NTIS $5.50.

The Reactor Safety System is designed to respond to reactor signals as explained in the original manual and previous addendums. Revisions to the Loss of A.C. Power Scram circuitry and the Drum Roll-In Detector circuitry are described, with acceptance tests, installation, operation and maintenance advice. (LTN)

19052 (WASH-1361) SAFETY-RELATED SITE PARAMETERS FOR NUCLEAR POWER PLANTS. (USAEC Directorate of Licensing, Washington, D. C.). Jan 1975. 21p. Dep. NTIS $3.75.

One approach to achieving greater standardization of nuclear power plants is the development of reference designs. To assure reference design compatibility with a reasonable number of potential plant sites, the designer must assume site conditions that are typical of areas where plants are most likely to be located. Values of the principal safety-related site parameters that have been used in the design of licensed nuclear plants are presented and discussed. (auth)

19053 (WCAP-7906) PWR FLECHT SYSTEM EFFECTS TEST PROGRAM PLAN. Cadek, F. F.; Blaisdell, J. A.; Suda, A. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Apr 1972. Contract AT(10-1)-1375. 46p. Dep. NTIS $5.50.

The test plan for the FLECHT System Effects Test (SET) Program is described. The test objective and philosophy are presented along with a description and design basis of the system and components. Also included are a test matrix, a discussion of measurement and analysis techniques, and a program schedule. The overall objective of the SET program is to provide experimental data on the influence of system effects on emergency core cooling (ECC) behavior during the reflood phase of a loss-of-coolant accident (LOCA). Ultimately, the test data obtained would be used to verify existing analytical techniques or would serve as the basis for the development of new ones. However, improvement of codes is not included in the scope of this program. (auth)

19054 (XN-74-21(Rev.1)) XTHETA: MULTI-NODE HEATUP CODE FOR SINGLE CHANNEL TRANSIENT ANALYSIS. Lang, F. D.; Steves, L. H.; Bjornard, T. A. (Exxon Nuclear Co., Richland, Wash. (USA)). 1 Jan 1975. 155p.

A detailed description of the XTHETA/MOD 002 code is provided. The code is used for predictive and post-test analysis of the LOCA thermal response of a PWR fuel rod. The theoretical treatment and methodology, built-in correlations, preparation of input, and interpretation of output are described, and a benchmark calculation is included. (DG)

19055 IEEE RECOMMENDED PRACTICES FOR SEISMIC QUALIFICATION OF CLASS 1E EQUIPMENT FOR NUCLEAR POWER GENERATING STATIONS. New York; Institute of Electrical and Electronics Engineers, Inc. (1975). 24p. (ICONS-01940; IEEE-Std-344-1975).

Recommendations are made for establishing seismic testing procedures for electrical equipment and systems essential in preventing significant release of radioactive material during and following earthquakes. (DG)

19056 NUCLEAR POWER PLANTS AND THE ENVIRONMENT. Gersten, G. W. pp 129-150 of Fifth FORATOM Congress. Bonn; Deutsches Atomforum e.V. (1973).

From 5th foratom congress on nuclear power plants in Europe; Florence, Italy (15 Oct 1973). See CONF-731039-.

The environmental aspects of nuclear power plants in the German Federal Republic are analyzed. 52 references. (DCC)

Reactor Theory and Calculation

Refer also to abstracts 18403 and 18991.

19057 (BARC-768, pp 152-158) FAST REACTOR PHYSICS. Navalkar, M. P.; Acharya, G. V.; Coachman, J. S.; Godwal, B. K.; Iyengar, S. B. D.; Joneja, O. P.; Phiske, M. R.; Ramakrishna, D. V. S.; Subbukutty, K. 1974.

In annual report of the Nuclear Physics Division, period ending December 1973.

19058 (CEA-N-1724) STUDY OF THERMALIZATION USING THE MONTE CARLO METHOD. Gonnord, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Reacteurs et de Mathematiques Appliquees). Jul 1974. 76p. (In French). Dep. NTIS (US Sales Only) $7.00.

Thesis. Submitted to Paris Univ., Orsay, France.

The three-dimensional polykinetic Monte-Carlo code TRIPOLI was adapted for neutron thermalization. The simulation of collision takes into account the speed distribution of atoms in the free gas option, and the molecular or crystalline bounds existing between the different atoms of a molecule or network in the molecular bounds option. The Egelstaff's model was used, the after-collision quantities being sampled directly from the scattering law $S(\alpha,\beta)$. The code was specially adapted for the treatment of lattice geometries. Thermal absorption of neutrons by pellets of self-shielded burnable poison distributed in such a core was calculated with good precision in reasonable computer time. (FR)

19059 (CONF-701074-P1, pp 186-197) NEW RESULTS OBTAINED FROM EXPERIMENTS OF REACTOR PHYSICS IN TZYAY. Bartz, K. U.; Raykhe, K.; Franke, E.; Livers, P.; Sholtz, I. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Works that are being carried out in Tzyay, Rossendorff, in the sphere of reactor physics, have lately been directed primarily to the methodological problems. From these the following may be noted: widening the possibilities of applying the Monte Carlo method for computation in nuclear reactors; development of program for calculating the correlation function; carrying out calculations of the Doppler effect on the basis of transmission function; construction of pile oscillator with reactance sensitivity equal to $\Delta \rho \leq 10^{-8}$; testing the statistical methods of measuring the negative reactivity; examining the possibility of improving the working control of power reactors of Atomic Electric Power Plants in operation by applying dynamic methods; and analysis of kinetic effects, in the annular core of the Rossendorff reactor type RRR, depending on the site. (auth)

19060 (CONF-741065-12) INTRODUCTORY REMARKS ON SMORN-1. Farinelli, U. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari). 1974. 4p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

19061 (CONF-741065-18) HEAT TRANSFER COEFFICIENT AND SOME OTHER REACTOR PARAMETERS DETERMINED FROM MEASUREMENTS OF FUEL TEMPERATURE AND NEUTRON FLUX FLUCTUATIONS. Isnard, R. 1974. 7p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The stochastic model developed in this theoretical and experimental research is quite satisfactory for analyzing neutron flux and fuel temperature fluctuations occurring in light water reactors with enriched uranium fuel, as it appears from experiments in two reactors of swimming pool type. The model in particular allows determination of the heat transfer coefficient between fuel and coolant from measurements of the spectral density of the temperature fluctuations to be found with good accuracy. The value of the neutron lifetime measured at powers ranging from 150 W to 50 kW is also in good agreement with value determined by other experiments. (auth)

19062 (CONF-741065-19) RELATION BETWEEN NON-LINEAR OR "NOT-LINEAR" CHARACTERISTICS IN NUCLEAR KINETICS AND NOISE ANALYSIS OF NEUTRON FLUX. Kataoka H. 1974. 28p. Dep. NTIS (US Sales Only) $4.50.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The "not-linear" or "2nd-class-nonlinear" characteristics in nuclear reactor kinetics combine with the feedback effect in the high-power operation and induce the increase in the amplitude of the neutron-flux noise, specially in the very low frequency region. The fundamental behavior of "not-linear" characteristics and its effect for the reactor noise are analyzed. 11 references. (auth)

19063 (CONF-741065-21) IMPACT OF TWENTY YEARS OF NOISE RESEARCH ON NUCLEAR POWER PLANT DESIGN, INSTRUMENTATION, AND CONTROL. Kemeny, L. G. (New South Wales Univ., Kensington (Australia). School of Nuclear Engineering). 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Some twenty years have elapsed since the first technical papers began to appear in a general field which can be loosely described as the statistical nature of the nuclear fission reaction and its influence on the criticality and dynamics of nuclear power systems. A few years subsequently, the first zero energy "neutron noise" measurements were reported in the scientific literature. These investigations clearly demonstrated that the time constants and the dynamic characteristics of low energy nuclear systems could be elegantly determined by the correlation or spectral analysis of fluctuating signals from ion chambers and proportional counters. Significant advances in the field were the recognition of the advantages of the two-channel cross-correlation technique and the realization that the dynamic behavior of a nuclear power plant at power could be monitored and studied in depth by the cross-correlation of mechanical, thermal and hydrodynamic signals with neutronic information. The former concept gave the spur to the development of theoretical models for spatial and energy dependent noise fields within a nuclear system. The latter technology, in principle at any rate, opened a floodgate of potential advances in nuclear power plant design optimization, control and safety instrumentation, and control and safety diagnostic systems. The present decade has seen the interaction of workers in the reactor noise field with workers investigating general vibrational phenomena and the structural mechanics of nuclear power plant. Despite this, it is sobering to reflect in retrospect that neither design, nor instrumentation and control concepts arising from noise research, have found any great measure of practical acceptance in current nuclear technology. The reasons for this unsatisfactory situation are explored, the few available practical examples of accepted noise technology are surveyed, and some definitive proposals with regard to the future implementation of nuclear power plant design, instrumentation, and control procedures, based on the concept of stochastic models and noise analysis, are made. (auth)

19064 (CONF-741065-28) DISCRETE PROBABILITY DISTRIBUTIONS IN NUCLEAR REACTOR NOISE. Pacilio, N.; Jorio, V. M. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Lab. Fisica e Calcolo dei Reattori). 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

A presentation is given of recent contributions of reactor noise analysis brought to the theory of probability and its applications, in terms of new profiles and distribution families. The well-known PMZBB (Pal-Mogilner-Zolotukhin-Bell-Babala) distribution, Türkcan and Dragt's first try to derive the probability profile from the generating function and Routti Szeless and Ruby's elegant computational procedures—based on the partitions of integer numbers—are recalled. In search of new probability distributions approximating the PMZBB profile, a number of generating functions have been introduced, analyzed and mutually compared. These functions lead to: (1) the Logarithmic distribution, (2) the Radical distribution, (3) the Algebraic distribution, (4) the Poisson-Logarithmic distribution, (5) the Poisson-Radical distribution and (6) the Poisson-Algebraic distribution. Distribution (4) is also known as Polya or Pascal or Negative Binomial distribution. Distributions (2), (3), (5) and (6) are absolute novelties in the field of probability theory. Distributions (4), (5) and (6) belong to the class of "generalized Poisson distributions," introduced by Gurland some years ago. (auth)

19065 (CONF-741065-39) SOME RESULTS ABOUT REACTOR NEUTRON FLUCTUATION ANALYSIS. Deiss, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1974. 3p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

19066 (CONF-741065-44) SURVEY OF RECENT APPLICATIONS OF REACTOR NOISE TECHNIQUES AT ARGONNE NATIONAL LABORATORY. Lewis, R. A.; Bennett, E. F.; Carpenter, S. G.; Cohn, C. E.; Price, C. C. (Argonne National Lab., Ill. (USA)). 20 Sep 1974. 42p. Dep. NTIS $5.25.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Recent applications of reactor noise techniques to the improvement of subcritical reactivity and β_{eff} measurements in fast critical assemblies and to fast power reactor surveillance by neutron/acoustic noise cross correlation are reviewed. The Inverse Kinetics Rod Drop (IKRD) technique has been the primary subcriticality measurement technique applied at ANL because of its relative insensitivity to counter efficiency and prompt lifetime changes and the fact that a near-critical reference is not needed. Estimates of the random errors in IKRD reactivity measurements resulting from noise effects have been developed by simulation studies and theoretical analysis. Relative standard deviations of 1 to 20% are indicated by these methods for initial Δk from -0.0005 to -0.035, respectively, under conditions typical of the Fast Test Reactor (FTR) mockup experiments in the ZPR-9 Fast Critical Facility. Space-dependent kinetics calculations have been applied to the IKRD technique to study systematic errors that are functions of detector location as well as changes in kinetics parameters and effective source strength in the course of a rod drop. In various situations, systematic errors from these causes may be as low as several parts per hundred for detectors located outside the axial reflector due to cancellation of errors. For other detector locations, the principal error components might be in the same direction, thereby amplifying the resultant error. Noise measurements have been used as cross checks on IKRD results. The break frequency derived from cross power spectral density or polarity correlation has been found not to be a good reactivity estimator in fast power reactor critical assemblies presumably because wide disparities between neutron lifetimes in the core and reflector produce deviations from point kinetics in the range of the break frequency. Various two-detector midfrequency polarity coherence function methods have produced good reactivity estimates, although these methods depend on near-critical reference measurements and are perturbed by differences in detector efficiency between the reference and measured systems. Correction methods to account for detector efficiency and β_{eff} changes have been developed. The accuracy of fast critical experiment measurements of $\Delta k/k$ is directly affected by the accuracy with which β_{eff} is known. Recent conflicting experimental data on β_i, λ_i has been the incentive for use of a noise-based integral β_{eff} measurement technique. The technique is a modified detector noise variance-to-mean method using sampling intervals from 8 to 200 sec; β_{eff} has been measured to a precision of ±2.9% in the FTR mockup critical assembly. Exploratory work on the use of neutron/acoustic noise cross correlation as a tool for surveillance of fast power reactor systems has been carried out using the Experimental Breeder Reactor II. Cross correlation of neutron signals from in-core detectors with acoustic signals from accelerometers mounted on various mechanical components connected into the core structure has been studied up to several thousand hertz. Flow-induced subassembly vibrations at about 10 hertz have been observed. (auth)

19067 (IFA-RT-6-1974) STUDY OF A NATURAL URANIUM-GRAPHITE LATTICE BY USING NEUTRON SOURCES. Racataian, I.; Postelnicu, C.; Mociornita, G.; Marcu, G.; Biciolla, L. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 12p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

An experimental study was made of the diffusion and multiplication parameters of a natural uranium-graphite lattice using a pulsed source of fast neutrons. The results obtained are tabulated. (JSR)

19068 (KFK-2070) INVESTIGATIONS OF THE TWO-DETECTOR COVARIANCE METHOD FOR THE MEASUREMENT OF COUPLED REACTOR KINETICS PARAMETERS. Edelmann, M.; Ehrhardt, J.; Vaeth, W. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Oct 1974. 35p. (CONF-741065-2). Dep. NTIS (US Sales Only) $4.75.

From EACRP specialist meeting on SMORN reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Investigations of two-detector covariance measurements and their application to the determination of coupled kinetics parameters are presented. This technique is compared with the Rossi-α method by theoretical considerations and measurements using identical detector signals in both analysis techniques. Results were also compared to those measured previously at the same reactor by frequency analysis. 46 references. (auth)

19069 (NIIAR-P-212) INTEGRAL EQUATION KERNEL FOR FISSION NEUTRON SOURCES OF A MULTIZONE SPHERICAL REACTOR IN m-GROUP P_1 APPROXIMATION. Makin, R. S.; Polivanov, I. F. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1973. 27p. (In Russian). INIS.

A method of solving a set of equations is presented for a multizone reactor in an m-group, P_1 approximation. The method is based on the results of three-dimensional potential theory. By means of this method it is possible to arrive at an equivalent integral formulation of the problem, to find an explicit expression for the kernel of the integral equation with respect to the unknown function of the fission-neutron sources, and to obtain an analytical expression for the neutron density in the reactor. This technique is realized for a spherical reactor with a central, active zone and reflector, which may consist of a number of zones. (tr-auth)

19070 (NP-20275) ANNUAL REPORT, 1973–1974. (Interuniversitair Reactor Instituut, Delft (Netherlands)). 1974. 139p. (In Dutch). Dep. NTIS (US Sales Only) $10.00.

The studies made in molecular physics, magnetism, reactor physics, radiation chemistry, radiometric and activation analysis methods, and health physics and dosimetry are briefly outlined. The activities of auxiliary groups in assisting with these studies are given. The publications and reports issued during the year are tabulated. (JSR)

19071 (WANL-PR(LL)-034(Vol.5)) NUCLEAR ROCKET SHIELDING METHODS, MODIFICATION, UPDATING, AND INPUT DATA PREPARATION. Volume V. Two-Dimensional, Discrete Ordinates Transport Technique. Soltesz, R. G.; Disney, R. K.; Jedruch, J.; Zeigler, S. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. 394p. Dep. NTIS $22.75.

The WANL version of the DOT computer code for solving the two-dimensional, energy dependent, linear Boltzmann transport equation with general anisotropic scattering, and the MAP computer code for solving for the angular, spatial, and energy dependent flux external to a nuclear system are described. The major improvements of the DOT-IIW code over the DOT code are the inclusion of acceleration techniques on the group flux solution, improved convergence logic, asymmetric quadrature capability, and improved tape operations. Detailed user information involving problem setup, running time, quadrature data, and mesh spacing requirements is described for both codes. In addition, requirements for eigenvalue, fixed volume distributed source, boundary source, and search calculations are given for the DOT-IIW code. Typical problem setup information is supplied for both codes as well as a description of the printed output. A sample problem card input and printout are included for each code. The DOQ and ADOQ quadrature coefficient calculation codes are described in an appendix. (auth)

19072 (WANL-PR(LL)-034(Vol.6)) NUCLEAR ROCKET SHIELDING METHODS, MODIFICATION, UPDATING, AND INPUT DATA PREPARATION. Volume VI. Point Kernel Techniques. Final Progress Report. Disney, R. K.; Zeigler, S. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. 296p. Dep. NTIS $18.00.

The KAP VI computer code for solving energy dependent radiation transport external to a radiation source is described. KAP VI is a revised version of the KAP V code and is written in standard USASI FORTRAN IV. Revisions include the data input interface with the GAMLEG-W and NAGS code, as well as options to preferentially exclude multiple scatter buildup approximations in certain zones. The KAP VI (Point Kernel Attenuation Program) code employs the point kernel method to calculate neutron and gamma ray radiation levels at detector points located within or outside a complex geometry (including the radiation source) describable by a combination of quadratic surfaces. The code can be used, for example, to calculate gamma ray and/or fast neutron flux, dose, or heating rate. The attenuation function, or kernel, for gamma rays employs exponential attenuation along with a buildup factor to account for multiple scales. Three optional fast neutron attenuation functions are included: (1) a modified Albert-Welton function for calculating fast neutron dose rate using removal cross sections; (2) a bivariant polynomial expression for computing neutron spectra using infinite media moment data; and (3) a monovariant polynomial expression for computing neutron spectra using infinite media moments data. The code also handles either cylindrical, spherical, disc, line, or point sources. A variety of options are available for describing neutron or gamma ray source distributions in complex geometries. The SCAP computer code for solving energy dependent radiation transport in a complex scattering geometry is described. The SCAP (SCatter Analysis Program) code employs the point kernel method to calculate the gamma ray or neutron radiation levels of a detector point located within or outside a complex scattering geometry describable by a combination of quadratic surfaces. The code employs an anisotropic point source represented as energy and angular dependent input values, single or albedo-scatter methods, and exponential material attenuation to calculate dose rates and gamma ray energy deposition at a detector point. (auth)

19073 (WANL-TME-1464) TRANSPORT THEORY STATUS REPORT. DeBaryshe, P. G.; Collier, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Jun 1966. 42p. Dep. NTIS $5.25.

Efforts to develop fast and accurate two dimensional S_N type neutron transport programs are described. Progress in improving the convergence rate of VARI-QUIR III, an R-Θ diffusion theory program, is presented. A substantial decrease in computer time results when S_N type programs are run with really good initial guesses. To attain this end standard diffusion codes have been modified to supply a flux guess for DDK, TDC, and DTK. In addition, the application of the Shanks acceleration technique to the problem of eigenvalue convergence has been studied so far without too much success. To improve the accuracy of S_N calculations, a method which prevents the occurence of negative fluxes near control vanes has been developed. A rigorous, but practical, method for including anisotropic scattering in diffusion theory calculations has been developed. This technique can provide better flux guesses for transport calculations and greatly improve diffusion results at interfaces. The cause of the slow convergence rate of the R-Θ version of VARI-QUIR has been discovered and the necessary corrections are being made. (auth)

19074 (WANL-TME-1748) POI: A COMPUTER PROGRAM IN FORTRAN IV. Collier, G.; Gibson, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1968. 25p. Dep. NTIS $4.25.

It is assumed that events occur randomly in time, e.g. emission by a radioactive source. During any time interval Δt the average number of events is B. The probability, $P_B(T)$, that T events will occur in a time interval Δt is: $P_B(T) = e^{-B}/T!\ B^T$, this is the Poisson Formula. A program is described that allows one to calculate: (a) the probability, $P_B(\geq T)$, that T or more than T events will occur during a time interval Δt, (b) the probability, $P_B(\leq T)$, that T or less than T events occur during a time interval Δt, and (c) the probability, $P_B(T)$, that T events will occur during a time interval Δt. (auth)

19075 (WANL-TME-1952(Rev.A)) RNPARX2 DATA SYSTEM USERS MANUAL. Revision A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1970. 235p. Dep. NTIS $14.75.

The RNPARX2 Data System Users Manual includes all changes made to the PARX2, PARX21, and DIRECT computer codes in order to permit subtraction of detector background radiation. The revised codes are presented in their entirety along with descriptions of the equations used. FORTRAN listings, sample output, and instructions for sequential execution of the programs are included. (auth)

19076 ON THE REACTOR NOISE DUE TO COOLANT FLOW FLUCTUATIONS. Singh, O. P. (Reactor Research Centre, Kalpakkam (India). Fast Breeder Test Reactor Design Group). Atomkernenergie; 24: No. 1, 65-66(1974).
9 refs.

The problem of reactor noise due to fluctuations in the flow of the coolant has been discussed by considering the fluctuations in the density of the coolant as a result of fluctuations in the flow. The expression for the power spectral density of the chamber output current has been modified correspondingly. Further, the flow fluctuation noise is discussed in the presence of flicker noise effect which comes from random fluctuations of neutron cross-sections caused by temperature fluctuations. The results of the analysis in a four zone reactor model are also reported. (auth)

Reactor Components and Accessories

Refer also to abstracts 16708, 17109, 17119, 17145, 17213, 17341, 17351, 17491, 17605, and 19111.

19077 (SAND-74-8025) FLUID FLOW TRANSIENT INTERACTIONS WITH AREA DISCONTINUITIES IN PIPING SYSTEMS. Murphy, L. M. (Sandia Labs., Livermore, Calif. (USA)). Dec 1974. Contract AT(29-1)-789. 32p. Dep. NTIS $4.75.

Linear one-dimensional shock wave theory is used to analyze fluid flow stress wave interactions in the region of area discontinuities in piping systems. The solution is applicable in cases where the fluid flow is nearly incompressible and the particle velocity is small compared to the fluid acoustic sound speed as in nuclear reactor coolant loops. The technique developed is analogous to the pressure, particle velocity matching techniques used in acoustics. (auth)

19078 IEEE RECOMMENDED PRACTICE FOR INSTALLATION DESIGN AND INSTALLATION OF LARGE LEAD STORAGE BATTERIES FOR GENERATING STATIONS AND SUBSTATIONS. New York; Institute of Electrical and Electronics Engineers, Inc. (1975). 10p. (ICONS-01941; IEEE-Std-484-1975).

Recommended design practices and procedures for storage, location, mounting, ventilation, instrumentation, preassembly, and assembly of large lead sealed-cell storage batteries are specified. Required safety practices are also included. (auth)

19079 EXPERIENCE WITH PRESSURE VESSELS IN THE MULTIPLE LAYER FORM OF CONSTRUCTION. Witschakowski, W. (BASF A. G., Ludwigshafen am Rhein (F. R. Germany)). VGB Kraftwerkstechnik; 54: No. 9, 609-610(Sep 1974). (In German).

18 figs.; 35 refs.

The solid wall and multiple-layer forms of construction are compared. The multiple-layer form of construction compared with the solid-wall vessel has one advantage. One problem with all designs of multiple-layer vessels is the fitting of lateral openings and holes of large diameter. When multiple-layer vessels with operating temperatures of over 400°C are put into operation, it should be borne in mind that the shrinkage necessary with the multiple-layer design must also be maintained under operating conditions. (auth)

19080 EXPERIENCE IN THE FABRICATION AND WELDING OF THICK-WALLED FORGINGS. Piehl, K. H. Rheinstahl Tech.; 11: No. 2, 100-112(1973). (In German).

22 figs.; 1 tab.

Large forgings are used for the fabrication of reactor pressure vessels for nuclear reactor plants which are connected to one another by using efficient welding methods in the construction of equipment. With the increasing capacity of the nuclear power plants, very large pressure vessels with weights of 500 t and more are necessary whose manufacture makes hitherto unknown demands of the producer of forgings and of the welding factory. This is particularly valid considering the high safety requirements which must be set for reactor pressure vessels and are reflected by the correspondingly strong criteria for the results of the destructive, nondestructive and measure testing. (GE)

19081 SETTING UP OF THE CONTROL OF THE ELEMENTS OF 110-750 kV DISTRIBUTION SYSTEMS IN NUCLEAR AND THERMAL POWER PLANTS. Semetov, A. N. Arch. Energiewirt.; 28: No. 18, 897-904(Sep 1974). (In German).

1 fig. Translated from Ehlektr. Stn., 1974, v.45(4) p. 72-74.

The author describes the organization of a central remote control and supervision of switches and other equipment in distribution systems of thermal power plants as well as technical solutions to enable such a controlling. (INIS)

Reactor Fuels

Refer also to abstracts 16139–16141, 17011, 17017, 17020, 17027, 17095, 17096, 17108, 17110, and 17531.

19082 (CONF-701074-P1, pp 150-167) FUEL CYCLES OF NUCLEAR POWER PLANTS. Gavelka, S.; Berak, L.; Kourzjim, V.; Peka, I.; Podesht, M.; Shrayer, V. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Information on power reactor fuel cycles is presented concerning the analysis of ceramic nuclear fuel, reprocessing of irradiated nuclear fuel, and the reprocessing of wastes that result during regeneration of irradiated fuel. (56 references) (DCC)

Reactor Control Systems

Refer also to abstract 16675.

19083 (CEA-N-1691) NUCLEAR ELECTRONIC EQUIPMENT FOR CONTROL AND MONITORING BOARDS. Specifications and Test Methods for Direct Current Periodmeters. Logarithmic Amplifiers, Differential Circuits, Threshold Triggering Circuits, h-t Supply, and Auxiliary Circuits. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). Nov 1973. 49p. (In French). Dep. NTIS (US Sales Only) $5.50.

The principal notations used are presented together with the definition of certain terms. The scope of the document is discussed and a bibliography given. The main specifications of the electronic sub-assemblies (dc periodmeters) used for the monitoring, control, and safety of nuclear reactors are then defined and the corresponding test methods described. The apparatus utilizes an ionization chamber to measure the neutron fluence of a reactor on a logarithmic scale and provides periodic information on the variations in the fluence rate with time. The specifications and test methods are given for the different components (logarithmic amplifiers; time differential circuits; threshold triggering circuits; h–t supply for the ionization chamber, auxiliary circuits, and finally for the complete periodmeter). (FR)

19084 (CONF-701074-P1, pp 362-371) EXPERIMENTAL DEVELOPMENT AND EXPLOITATION OF CONTROLLING MECHANISM OF WATER-COOLED WATER-MODERATED POWER REACTORS. Shmelev, V. D.; Sokolov, A. S.; Anisimov, V. S.; Stekolnikov, V. V.; Denisov, V. P.; Naletov, V. I.; Blot, V. E. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovendenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

A brief description of the controlling mechanism used in reactors of the first Novovoronezj and Rhinesberg Atomic Electric Power Plants as well as boiling reactor VK-50 are given, and the changes in the construction of mechanism that were carried out as a result of their experimental development and results of operation are included. The constructive changes were realized in the driving gear of ARK of the second block of Novovoronezj Atomic Electric Power Plant. (auth)

19085 (GEAP-13771-12) CRITICAL EXPERIMENTS AND ANALYSIS TWELFTH QUARTERLY REPORT, JULY–SEPTEMBER 1974. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Sep 1974. Contract AT(04-3)-893. 54p. AT.

Current activities and technical progress for the period July through September 1974 are reported for two subtasks. Subtask A covers the technical direction for critical experiments and analysis as applicable to LMFBR commercial plants and the Clinch River Breeder Reactor Plant Benchmark Critical Experiments in ZPPR Assembly 4 and the CRBRP EMC. Subtask B is directed toward the development of LMFBR plant calculational methods that also can be used at the sites of the Clinch River Breeder Reactor to determine the reactor power distribution, reactivity and fuel status, and for consideration of alternate fuel and control management schemes. 13 references. (auth)

19086 (GKSS-74/E/34) NS OTTO HAHN: RESEARCH REPORT NO. 8. A Minicomputer System for Plant Monitoring on the NS Otto Hahn. Boettcher, G.; Petersen, P.; Ramus, A.; Robinson, E. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F.R. Germany)). 1974. 15p. (CONF-740683-1). Dep. NTIS (US Sales Only) $4.00.

From meeting on computer control and fuel research related to safe and economic plant operations; Sandefjord, Norway (3 Jun 1974).

In the control room of the ship propulsion reactor OTTO HAHN a 400 channel data acquisition system is installed. Central part of it is a free programmable minicomputer with an 8 K, 8 bit ferrite magnetic core memory. The basic function of this minicomputer system is plant surveillance. 200 alarms are monitored and 200 analog signals can automatically be logged. A special hardware, including an external semi-conductor memory provides that in case of a disturbance of the plant the first 32 alarms are documented. From the measured analog signals a plant performance log is calculated. In special measurements, as reactivity determination by inverse kinetics technique or reactor noise analysis, specified analog signals can be digitized and stored on a magnetic tape for further calculations done on a scientific computer. 4 references. (auth)

19087 (HEDL-TME-74-3(Vol.3)) HEDL QUARTERLY TECHNICAL REPORT, JULY–SEPTEMBER 1974. Volume 3. Reactor and Safety Engineering. Slember, R. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1974. Contract AT(45-1)-2170. 35p. AT.

Information is presented concerning LMFBR doubling time, FFTF safety studies and kinetics, and gamma heat deposition and reactivity worth of Eu_2O_3 control elements. (DCC)

19088 (WANL-TME-295) ENGINE TEST REACTOR CONTROL SYSTEM, DWG. 707J870. Kendziorek, W. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Mar 1963. 16p. Dep. NTIS $4.00.

Since more complexity is required for an engine test controller than for a flight controller, the system described is rather complicated and offers a choice of 5 basic modes of control. They are suitable for control rod check-out, physics tests, power experiments, semiautomatic and fully automatic (only the latter over the full operating range). All manual and semiautomatic modes involve operation at limited power (about 1 percent). Control can be shifted between modes by push buttons. The description involves detailed text and circuit diagrams. (LTN)

19089 (WANL-TME-1169) NRX-A3 EP-VI CONTROL TEST ANALYSIS AND SIMULATION. Cooper, K.; Junker, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 May 1965. 25p. Dep. NTIS $4.25.

Control tests to be performed on the NRX-A3 reactor were simulated on the three console model of the reactor and feed system by subjecting the model to step and sinusoidal perturbations, which ranged in frequency from 0.16 to 16 Hz. The simulation was done to determine the permissible magnitude of perturbations during the actual test. The results indicate that usable information can be obtained without exceeding the chamber temperature, tie rod temperature and flow variation limits of 2500°R, 1000°R and 7 lbs/sec periods of less than 0.6 second did not occur and, in the majority of tests, periods of less than 1 second were not found. (LTN)

19090 (WANL-TME-1459) OPERATIONAL MANUAL FOR THE XE-1 CONTROL DRUM ACTUATOR AMPLIFIERS. Bartholomew, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Sep 1966. 39p. Dep. NTIS $5.00.

19091 (WANL-TME-1592) NRX-A6 CONTROL SYSTEMS DESCRIPTION. Loftus, W. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1967. 128p. Dep. NTIS $9.50.

The NRX-A6 Reactor Controller consists of the manual drum controller, temperature controller, power controller, temperature limiter, power limiter, and the power auto-start programmer. The indication and mode switching circuits and the demand pot followup servos are integral accessory components. The following systems or components interact with the Reactor Controller: (a) Drums System. The reactor controller provides drum position demand input to this system. (b) Power and Temperature Programmers. The programmers supply log power and temperature demand inputs to the reactor controller. (c) The temperature sensors, signal conditioners, and temperature averaging circuits. These components provide measured temperature input to the temperature controller. (d) The nuclear detectors, log amplifiers, signal conditioners, and log power auctioneer. Measured log power input to the power controller is supplied by these components. (auth)

19092 (WANL-TME-1625) STABILITY ANALYSIS OF THE NERVA XE CONTROL DRUM ACTUATOR SERVOVALVE. Buckley, S.; Armstrong, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1967. 39p. Dep. NTIS $5.00.

Reappraisal of the possible NERVA XE actuator temperature environments toward lower limits has precipitated an intensified investigation culminating in a modified actuator servovalve of improved low temperature stability. The requirement for removal of trace contaminants from the XE actuator drive gas by cryogenic entrapment, coupled with revised requirements for operation with coolant gas temperatures at extremes far below design values, has contributed to the necessity for requalification of the actuator at temperatures which have previously evidenced valve stability problems. Valve oscillation attendant with operation on very cold helium had occasioned loss of actuator control characterized by intermittent inward position drift. While no such erratic behavior had been experienced with hydrogen, the inference of little stability margin was strong. Insight into the intricacies of the oscillation mechanism awaited expansion of facilities to permit testing with helium and hydrogen at sustained temperatures near 100°R. These facility modifications combined with significant instrumentation problems to delay acquisition of diagnostic data. When data adequate to support a detailed stability analysis became available, the manufacture of XE-1 hardware had progressed beyond the point where extensive changes could be economically incorporated. Consequently, attention was directed primarily toward remedial modifications which could be efficiently implemented into the actuator subsequent to their manufacture at General Electric. In the analysis delineated, additions are made to the subsystem transfer functions which refine the model to include the previously neglected pneumatic impedance of the actuators internal ducting. The corrected mathematical model displays pneumatic resonances identifying the origin of the oscillation and suggests parameter alterations to promote stability. Three of these were ultimately adopted for incorporation into the XE-1 hardware as a result of extensive testing which substantiated the theoretical analysis. A material substitution for the valve nozzle flapper screw, a readjustment reducing the quiescent cylinder pressure, and the addition of pneumatic resistive damping elements comprise the selection. Subsequent testing of each modified XE-1 actuator has confirmed that the oscillation is effectively inhibited and that no significant compromise in performance or reliability has been introduced. (auth)

19093 (WANL-TME-1786) XE-1 CONTROL DRUM BEARING DEBRIS TEST. Solie, W. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1968. 19p. Dep. NTIS $4.00.

During routine operations at NRDS, debris was found on the XE-1 nozzle end ring, adjacent to the integral control drum bearing housings, which could have entered the bearings and control drum annulus, so a series of control drum torque tests was performed at reactor temperature and simulated pressure conditions to demonstrate that the control drum assembly would operate satisfactorily even when contaminated with debris. Actual debris from the XE-1 reactor was inserted into the test control drum through the aft bearing and housing to simulate a condition that could exist. Cycling tests were performed on the control drum and the maximum torque recorded was approximately 21 in.-lbs. At the end of the cycling tests, the torque had reduced to 15 in.-lbs. These values should be compared to a base line torque of approximately 5 in.-lbs established on the same hardware in the "clean" condition. Based on these results no problem is expected with the XE-1 control drum bearings even if they become contaminated with debris. (auth)

19094 (WANL-TME-1795) NRX-A6 CONTROL DRUM FLOW TESTS. Jacob, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Jul 1968. 43p. Dep. NTIS $5.25.

Hydrogen flow impedance tests were conducted on an NRX-A6 control drum at the WANHES test facility. The tests were conducted in a full flow configuration and full flow with transverse slits. Experimental pressure and flow relations compared well with calculated values using the same analytical model used for the NRX-A6 predictions. The test conditions provided a Mach Number and Reynolds Number adequate to permit direct application to the flow conditions. Tabulated photographic data for the full flow and full flow with slits are presented as well as plots of the inlet plenum density times the control drum pressure drop versus flow rate. (auth)

19095 (WANL-TME-1954) XE-1 CONTROL DRUM PNEUMATIC ACTUATOR. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Sep 1969. 232p. Dep. NTIS $14.75.

An XE pneumatic control drum actuator, specifically of the XE-1 build, has been subjected to a complete series of environmental tests to determine the actuator's capability to operate in the XE environment and to provide input to future NERVA design. A series of formal dynamic and static tests was conducted in environments of vibration; mechanical shock; low temperature and thermal shock; and combined low temperature and vibration. An operating life test was also performed. At the successful conclusion of the above series of tests, a disassembly and inspection of the test actuator gave no indication of wear or damage; therefore, an extended life test to failure was conducted on the same actuator mechanism to provide further information to follow-on programs. The test results were examined and evaluated to determine potential effect on subsystem ability to meet performance requirements. The few anomalies were the result of an overambitious set of limits and in all cases performance was adequate to meet performance requirements. In addition to the formal life test on this XE-1 unit, the results of the A-6 pneumatic actuator side-by-side radiation test are included. Successful operation during this test and subsequent disassembly and inspection proved conclusively the ability of this design to function successfully in a radiation field. A secondary result of this test was to prove the adequacy of the design cooling to remove gamma generated heat. (auth)

19096 INFORMATION SYSTEM USING A MULTIPLEX DATA TRANSFER SYSTEM IN AMERICAN NUCLEAR POWER PLANTS. Union, D. C. (Gulf General Atomic Co., San Diego, Calif. (USA)); Bedenig, D. (General Atomic Europe, Zurich (Switzerland));

Schneider, W. (Brown, Boveri und Cie A. G., Mannheim (F. R. Germany)). Atomwirt., Atomtech.; 19: No. 10, 481-483(Oct 1974). (In German).

5 figs.; 6 refs.

Today, process computer systems are used in order to improve the informational presentation of nuclear power plants. In the USA, however, they do not have the function of automatic plant control. The transformation of information out of process computers into actions for controlling the plant is done by the operator. The multiplex data transfer system offers considerable technical improvement. It allows the substitution of extensive information cabling nets by just a few lines. The processing of the information is done by a redundant process computer system with 16-bit-structure. The control room is equipped with color pictured vision sets and efficient recording instruments which guarantee a clear representation of the plant condition, of trends and documentation of the operation by means of corresponding software programs. This concept differs from the pilot technique common in Europe not only in the design of the control room but also in the application of the multiplex data transfer system. (auth)

Nuclear Power Plant Economics

19097 (CONF-701074-P1, pp 39-53) USES OF NUCLEAR POWER IN THE GERMAN DEMOCRATIC REPUBLIC. Ray, A.; Haine, L. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

19098 (CONF-701074-P1, pp 114-133) PROGRAM FOR ESTIMATING THE DEVELOPMENT TREND OF NUCLEAR POWER IN THE CZECHOSLOVAK SOCIALIST REPUBLIC. Novak, S.; Raitzi, T. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The complexity of the problems of development of atomic electric power plants requires careful consideration of a whole series of factors determining the effectiveness of the selected course. For estimating the separate factors influencing the development of atomic electric power plants in the Czechoslovak Social Republic, a planned program has been prepared. The basic characteristics of this program, the input data and progress of planning are presented. The influence on the selection, of the starting period of development, of atomic electric power plants is evaluated on the basis of natural and economic factors. Attention is directed to the question of cooperation between the atomic electric power plants and other power stations in the system (changes in the time of operation, problems requiring dynamic properties etc.). A series of computed results are given, for several variations of the starting period of development for natural factors for a period of 50 years and economic factors for 20 years. (5 references) (auth)

19099 (CONF-701074-P1, pp 222-240) PROBLEMS IN CONSTRUCTING THE ATOMIC ELECTRIC POWER PLANTS IN THE GERMAN DEMOCRATIC REPUBLIC. Rambush, K. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

In connection with the wider application of nuclear power for covering the requirements of electricity and thermal energy in German Democratic Republic, requirements for international division of labor are brought forward, specially for those operations that fall to the lot of German Democratic Republic. The necessary perspective requirements for the growth of power of separate units and atomic electric power plants on the whole are explained, the influence in selecting the sites for atomic electric power plants and the principal necessary economic and national economic expenditure and effects are also discussed. (auth)

19100 (FRNC-R-35) REPORT OF THE ADVISORY COMMITTEE FOR NUCLEAR ELECTRICITY PRODUCTION. (Ministere du Developpement Industriel et Scientifique, 75 - Paris (France)). Apr 1973. 20p. (In French). Dep. NTIS (US Sales Only) $4.00.

Recent information on and development prospects of nuclear energy activities in France are discussed. Part one deals with the situation and prospects of commercial light water reactors, with special reference to the competitiveness and relative general advantages of nuclear stations and conventional stations, at present and potentially. Advice is given on the basis of these considerations, regarding the volume of the Electricite de France nuclear program over the next few years. Part two examines the prospects for the year 2000, the aim being to establish the interactions between fissile matter needs and availabilities and the program volumes and distributions among the different reactor types, present or future. (FR)

19101 (FRNC-R-35(App.)) ANNEXES TO THE REPORT OF THE ADVISORY COMMITTEE FOR NUCLEAR ELECTRICITY PRODUCTION. (Ministere du Developpement Industriel et Scientifique, 75 - Paris (France)). Apr 1973. 57p. (In French). Dep. NTIS (US Sales Only) $6.00.

The energy prospects for 1985 in France are examined and a rough plan of the outlook for 2000 is presented. A survey of the nuclear programs in several countries and the world total of nuclear power stations on December 31, 1972, is followed by a discussion on economic and financial calculations for the quantitative light-water program, the insertion of power stations in the charge diagram and their availability problems raised by the transport of large heavy equipment and an evaluation of the long-term needs and availabilities of fissile materials according to the nuclear program break-down among the reactor families. (FR)

19102 FINLAND'S NUCLEAR ENERGY SWALLOWS UP BILLIONS. Four New Nuclear Power Plants Planned Up to 1984. Handelsblatt; 29: No. 187, 4(Sep 1974). (In German).

The Finnish power economy has a capital demand of some 40 billion finmarks for the next 10 years. 41% of this goes to power plants including nuclear power plants. Up to 1984, four new nuclear power plants have been planned. (GE)

19103 FIFTH FORATOM CONGRESS, FLORENCE, ITALY, OCTOBER 15-17, 1973. Bonn; Deutsches Atomforum e.V. (1973). 225p. (CONF-731039-). American Nuclear Society, Hinsdale, Illinois, DM18,95.

Separate abstracts are included for each of the six papers presented concerning the development of nuclear power plants in the German Federal Republic. (DCC)

For abstracts of individual papers see: 18741, 19056, and 19104–19107.

19104 EXPERIENCE ACQUIRED IN THE DESIGN AND CONSTRUCTION OF OPERATING PLANTS. Kornbichler, H. pp 1-30 of Fifth FORATOM Congress. Bonn; Deutsches Atomforum e.V. (1973).

From 5th foratom congress on nuclear power plants in Europe; Florence, Italy (15 Oct 1973). See CONF-731039-.

Information concerning the development of nuclear power plants in the German Federal Republic is presented concerning light water reactors, high temperature reactors, heavy water reactors, special reactor types, breeder reactors, objectives pursued in the development of nuclear power plants, economics, experience acquired during construction and operation, licensing procedures, collaboration with nuclear research centers, and the effects of reactor construction on the industrial structure. (DCC)

19105 STATUS AND DEVELOPMENT OF NUCLEAR POWER IN THE FEDERAL REPUBLIC OF GERMANY. Altvater, W. (Kraftwerk Union AG, Erlangen, Ger.); Haussmann, H.; Stueger, R.; Stuenkel, H. pp 64-127 of Fifth FORATOM Congress. Bonn; Deutsches Atomforum e.V. (1973).

From 5th foratom congress on nuclear power plants in Europe; Florence, Italy (15 Oct 1973). See CONF-731039-.

Information on the development of nuclear power plants in the German Federal Republic is presented concerning site selection, organization of planning and actual construction, design and fabrication of reactor components, collaboration between NSSS and component manufacturers, and costs and economics. 11 references. (DCC)

19106 INDUSTRIAL DEVELOPMENT PROSPECTS. Huenlich, W. H. F.; Altvater, W.; Braatz, U.; Keese, H.; Simon, W. pp 151-187 of Fifth FORATOM Congress. Bonn; Deutsches Atomforum e.V. (1973).

From 5th foratom congress on nuclear power plants in Europe; Florence, Italy (15 Oct 1973). See CONF-731039-.

The projected development of nuclear power plants and nuclear related industries in the German Federal Republic is analyzed. (DCC)

19107 JOINT ROLE OF PROVEN, ADVANCED, AND FAST REACTORS. Kraemer, H. pp 189-225 of Fifth FORATOM Congress. Bonn; Deutsches Atomforum e.V. (1973).

From 5th foratom congress on nuclear power plants in Europe; Florence, Italy (15 Oct 1973). See CONF-731039-.

The development of PWR and BWR reactors in the German Federal Republic is reviewed. Projected economic aspects of water-cooled reactors are presented. The planned development of HTGR and LMFBR type reactors is discussed. 12 references. (DCC)

Reactor Fuel Cycle Economics

19108 (CONF-701074-P1, pp 515-534) EFFECTIVE USE OF FUEL IN FAST NEUTRON POWER REACTORS. Leipunskii, A. I.; Orlov, V. V.; Troyanov, M. F.; Litkin, V. B. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

The question of large scale development of atomic power is linked with the problem of effective utilization of natural reserves of fission material. Limitation of comparatively cheap uranium resources may result in an increased expenditure of power production by atomic electric power plants. The expenditure of uranium in the development of atomic power using only thermal reactors will bring about, as early as 1990, a rise in price of the fuel cycle because it will be necessary to change over to much more expensive uranium ores. Therefore, in the economy of natural resources of uranium the fast power reactors play an important part. It is shown how the expenditure of fission material affects the results, under different tempos of growth, such characteristics of reactors as specific loading, burnup fraction, conversion (breeding) ratio and the time of external fuel cycle. (auth)

19109 (CONF-701074-P1, pp 634-655) OPTIMIZATION OF THE FUEL CYCLE IN FAST REACTORS. Mitenkov, F. M.; Usinin, G. B.; Chirkov, V. A.; Shibaev, V. A.; Shlokin, B. A. 1971. Translated from Trudy Nauchno-Tekhnicheskoi Konferentsii "Atomnaya Energetika, Toplivnye Tsikly, Radiatsionnoe Materialovedenie", Ul'yanovsk, 5–10 Oktyabrya 1970.

From conference on atomic power, fuel cycles, and radiation study of materials; Ul'yanovsk, USSR (5 Oct 1970).

In proceedings of the scientific-technical conference "atomic power, fuel cycles, radiation study of materials".

Analytical results for selecting the sizes of fuel packet and systems of fuel reloading in the fast neutron power reactors are presented. The influence of the reloading multiplicity factor of the core and the interval of the continuous working of the reactor on the quantity of fuel in the cycle, conversion ratio and doubling time is analyzed. It is shown, that very infrequent reloadings cause a deterioration in the economy of the fuel cycle, the most significant factor for reactors with low inner conversion ratio. The possibility of improving the reactor characteristics by more rational use of fuel which is unloaded from the reactor is discussed. (auth)

Reactor Licensing and Regulation

Refer also to abstract 19052.

19110 (RAI-74-12) REGULATORY ADJUDICATION ISSUANCES AND ISSUANCES OF THE BOARD OF CONTRACT APPEALS, DECEMBER 1974. (USAEC Technical Information Center, Oak Ridge, Tenn.). Jan 1975. 254p. TIC.

Issuances received from the U. S. Atomic Energy Commission, the Atomic Safety and Licensing Appeal Boards, the Atomic Safety and Licensing Boards and the Board of Contract Appeals are presented. (auth)

19111 IEEE STANDARD FOR TYPE TESTS OF CONTINUOUS DUTY CLASS 1E MOTORS FOR NUCLEAR POWER GENERATING STATIONS. New York; Institute of Electrical and Electronics Engineers, Inc. (1974). 16p. (ICONS–01925; IEEE–Std-334-1974).

This standard provides direction in demonstrating the adequacy of continuous duty Class 1E electric motors, both inside and outside the containment of nuclear power generating stations, to perform all of their required Class 1E functions under all required service conditions. (auth)

GENERAL AND MISCELLANEOUS

Civilian Defense

19112 (NCRP-42) RADIOLOGICAL FACTORS AFFECTING DECISION-MAKING IN A NUCLEAR ATTACK. (National Council on Radiation Protection and Measurements, Washington, D. C. (USA)). 15 Nov 1974. 73p. (ISBN-0-913392-24-3).

Data on nuclear weapons, residual radiation, fallout, and effects of radiation on men are reviewed to assist in preparedness activities for large disasters in which exposure of many people to nuclear radiation is of primary concern. In particular, those officially responsible for civilian preparedness against nuclear attack should find this report a basic resource for their task. It is an attempt to describe the important characteristics of radiation, with emphasis on radioactive fallout, and radiation injury so that they can be understood by people who will be responsible for decision-making in civil defense operations in a nuclear attack. The recommendations must be regarded as reflecting the NCRP's best effort to evaluate information presently available; they may be modified as more knowledge becomes available. (CH)

Energy Utilization and Economics

19113 (LA-UR-74-1412) NUCLEAR PROPULSION TECHNOLOGY TRANSFER TO ENERGY SYSTEMS. Altseimer, J. H.; Balcomb, J. D.; Keller, W. E.; Ranken, W. A. (Oak Ridge National Lab., Tenn. (USA)). 1974. Contract W-7405-eng-36. 11p. (CONF-741063-1). Dep. NTIS $4.00.

From 10th AIAA/SAE propulsion conference; San Diego, California, USA (21 Oct 1974).

At Los Alamos, space technology has been applied to terrestrail energy problems. Four examples illustrate this transfer process: (1) heat pipe technology developed for space power supply systems cooling is being adapted to the methanation of synthetic natural gas from coal, (2) high temperature materials from the Rover nuclear engines are being adapted to an excavation concept based on melting rocks or soils, (3) high temperature graphite fuel technology is being applied to high temperature gas cooled reactors and, (4) cryogenic hydrogen and helium technology is being applied to superconducting electric power transmission and storage systems. An overview description of the above projects is presented in the hopes of stimulating thinking with regard to the transfer of space technology to terrestrail energy problems. (auth)

19114 (SC-DR-69-398) DESIGN, DEVELOPMENT, AND TESTING OF A CABLE ASSEMBLY FOR USE IN SEVERE ELECTROCHEMICAL ENVIRONMENTS. Voida, G. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1969. 41p. Dep. NTIS $5.28.

The design, development, and testing of a cable assembly suitable for use in a severe environment of alkaline electrolyte are described. Engineering data on the insulated conductor and terminations which prove the cable adequate for resisting the electrochemical activity of field use are presented. Test results of development and production cables are presented to illustrate the stability of the design under many years of simulated field applications. Numerous unusual potential uses of the cable assembly are also listed. (33 figures, 6 tables) (auth)

19115 HYDROGEN AND NUCLEAR ENERGY. Marchetti, C. (International Inst. for Applied Systems Analysis, Laxenburg, Austria). J. Brit. Nucl. Energy Soc.; 13: No. 4, 353-362(Oct 1974).

The potential use of hydrogen as an energy medium is discussed. Its suitability in relation to transportation and storage is evaluated. It has considerable market potential and applications in metallurgy, transport, and domestic fields are being studied. The relation between hydrogen and electricity as intermediates for nuclear heat is considered, and methods of hydrogen production from nuclear heat, particularly the thermochemical process adopted at ISPRA, are described. (UK)

Law

Refer also to abstract 16783.

19116 AEC STAFF STUDY OF THE PRICE-ANDERSON ACT. II. At. Energy Law J.; 16: No. 4, 297-349(Win 1975).

It is stated that if reactors are safe and licensable, then there is no reason for a limitation of liability as set forth by the Price-Anderson Act of limiting aggregate liability for a single nuclear incident at 560 million dollars. A review of the Act in 1965 upheld the Price-Anderson legislation, but observed that in the event of a national disaster of this magnitude, that Congress would have to review the problem and take action. Legislation dealing with facilities other than power reactors and reprocessing plants such as transportation systems for radioactive materials is discussed. (MCW)

Management

Refer also to abstract 16525.

19117 (CONF-741086-2) RESEARCH AND DEVELOPMENT NEEDS OF NUCLEAR ENERGY CENTERS. Spiewak, I. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 9p. Dep. NTIS $4.00.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

The studies of nuclear energy centers have emphasized large clusters of light-water power reactors. The standard nuclear energy center usually contains light-water reactors, integrated fuel cycle facilities, and nuclear waste storage. Optional features include more advanced reactors and co-located industry. A power center might contain nuclear and/or fossil fuel power plants. A "nuplex" would contain power reactors and heavy industry, and may have surplus power for sale by the utility. If coal liquefaction gasification becomes practical, "coalplexes" may become gigantic concentrations of energy and industry. These complexes have potential for improved energy conservation and limited energy cost increases. Three studies reported on are at Hanford, Washington; Riverbend, Louisiana; and a study by the Philadelphia Electric Co. Generic studies include thermal discharge modeling, control of radiologic discharges, electric power transmission, improved construction methods, design of fuel and waste facilities, study of institutional problems, socioeconomic impact modeling, and regional modeling and site criteria. Environmental effects and cost-benefit analyses are studied. (MCW)

19118 (NP-20293) SECOND ACTIVITY REPORT, 1973. (Organization for Economic Co-Operation and Development, 75-Paris (France)). [nd]. 58p. Dep. NTIS (US Sales Only) $6.00.

This second NEA activity report comprises four chapters entitled: nuclear power (present and future), regulatory aspects, technical development, and nuclear energy information. A number of changes in the program and priorities of NEA were brought into effect during 1973. These changes involved a greater policy orientation than previously in the Agency's work, with increasing attention to such matter as radiological protection, safety of nuclear installations, radioactive waste management, and the basic legal and administrative framework necessary for the satisfactory regulation of problems in these fields. In addition, preliminary work began toward improved public understanding of nuclear energy. (FR)

19119 (PRNC-176) ANNUAL REPORT, 1973. (Puerto Rico Nuclear Center, San Juan). 1973. Contract AT(40-1)-1833. 212p. Dep. NTIS $7.60.

PRNC was established in October 1957 to provide training in nuclear technology that would contribute to the technology development of Latin America. Research progress is reported on radiation oncology; nuclear medicine; biomedical sciences; radioecology; tropical agro-sciences; applied physical sciences; nuclear applications projects of neutron diffraction, hot atoms and radiation chemistry, and nuclear engineering; health and safety; and reactor operations. A report on the environmental studies for the Guayanilla Bay Project is included. (MCW)

Mathematics and Computers

Refer also to abstracts 16836 and 16928.

19120 (BNL-19365) BROOKNET: A HIGH SPEED COMPUTER NETWORK. Campbell, G. H.; Fuchel, K.; Padwa, S. L.; Schumburg, N. F. (Brookhaven National Lab., Upton, N. Y. (USA)). Sep 1974. 6p. (CONF-741140-1). Dep. NTIS $4.00.

From 3rd proceedings of the Texas conference on computing systems; Austin, Texas, USA (7 Nov 1974).

Brooknet is a digital communication network wherein a number of computers (currently 17) of different manufacture, are joined to a central facility consisting of two CDC 6600's and one million words of Extended Core Storage. The links are over co-axial cable allowing a transmission rate of 12 Megabits. Remote Stations make use of this facility for remote job entry, data collection at the central end, and file management. The special hardware and re-entrant software are described, and figures given on system utilization, response times, overhead, and failure rates. (auth)

19121 (BNWL-B-3) LINE PRINTER INTERFACE TO THE PNL HYBRID COMPUTER FACILITY. Busness, K. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1970. Contract AT(45-1)-1830. 33p. Dep. NTIS $4.75.

A high speed device to output program listings, assembly data, compilation data, and computation results was developed to link a medium-speed line printer and the two digital computers in the hybrid facility. An interface was developed and constructed to enable multi-computer usage of a Potter Instrument HSP3502 Chain Printer. The interface permits joint access to the printer by a PDP-9 and a PDP-7 digital computer. Computer data is output to the interface as an 18-bit word containing three characters. The full-line buffer printer with a 64-character font prints at a 315 line per minute rate. (MCW)

19122 (JAERI-M-5550) MULTI DATA COMPARING SUBROUTINE GPLOTZ. The Extension of General-Purpose Graph Producing Subroutine GPLOT1, and Application to the NESTOR Data Information System. Hasegawa, A. (Japan Atomic Energy Research Inst., Tokyo). Feb 1974. 27p. (In Japanese). INIS.

The General-Purpose Graph Producing System GPLOT 1 is extensively used in JAERI and other organizations. The inconveniencies experienced in its usage for comparison of several data were: (1) identification labels of individual data groups missed in multiple data comparison of several data groups, belonging to the same page; (2) impossibility of producing several results plotted over different ranges of an independent variable; and (3) inadequate treatment of the scaling-out problem. The subroutine GPLOTZ has been developed to deal with these problems. Aiming at the multiple data comparison of up to 100 data-groups, all the data processed are stored in one-dimensional array for computer economy. As a system of the subroutine type like GPLOT 1, the data processed and specification of the graph are defined by the arguments of calling program. When used in user's programs, it can treat the computed results as data for plotting. The functions of fully automatic scaling and multiple comparison plotting are retained in this system. The system is powerful in data comparison, especially with large amounts of data. Written in FORTRAN IV, it may be used with any CalComp plotting systems. An application is given, using data from the experimental cross section data information system NESTOR. (auth)

19123 (JINR-11-6935) USING PRINCIPLES OF BS-1M INTERFACE FOR DATA TRANSMISSION BETWEEN TRA AND OTHER COMPUTERS. Galaktionov, V. V.; Kindzierski, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 13p. (In Russian). INIS.

A description is given of a variant of a remote computer access terminal by means of Fortran exchanges which are established at measuring-computing centers of the laboratory. The Fortran stations are intended for remote exchange of data with a BESM-6 computer over connecting communications lines and are built on a base of a small computer TRA 1001. This study indicates the main principles of using the interface BS-1M to assure programming communication between the BESM-6 computer and the TRA 1001 computer. (tr-SJR)

19124 (JINR-P13-8272) CONTROLLER INTERFACING THE CAMAC SYSTEM WITH THE COMPUTER M-6000. II. Principal Schemes of the Controller M-6000. Bespalova, T. V.; Golutvin, I. A.; Kondrashov, V. D.; Smolin, D. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The description of the controller M-6000 intended for interfacing the CAMAC system with the computer M-6000 is given. The principal schemes of separate controller units are presented as well as the program for adjustment and check-up of the controller M-6000 operation under different regimes of the information exchange when operating through the programmed channel or direct memory access (DMA) of computer. (auth)

19125 (KAPL-M-7372) DATATRAN USER'S GUIDE. Kopp, H. J. (ed.). (Knolls Atomic Power Lab., Schenectady, N. Y. (USA)). Oct 1974. Contract W-31-109-Eng-52. 91p. Dep. NTIS $7.75.

DATATRAN 2 is a data base management language that is used as the environment for a modular computer program network. This manual serves as an introduction for FORTRAN programmers. (auth)

19126 (SAND-74-8672) PROCEEDINGS OF THE SYMPOSIUM ON DIGITAL SIGNAL PROCESSING, NOVEMBER 18, 1974, ALBUQUERQUE, NEW MEXICO. Soderstrand, M. A. (ed.). (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 47p. (CONF-741138-).

Seven papers and summaries of two papers are presented. Topics include (1) the digital filter as a systems element; (2) signal processing applications at LLL; (3) system processing activities at SLL; (4) digital system development in Organization 1100; (5) signal processing activities at LASL; (6) recursive digital filter structures and applications; (7) stability in two-dimensional recursive digital filters; (8) some aspects of spectral analysis and waveform reconstruction; and (9) optical data processing. (WHK)

19127 (UCRL-51691) NEAR FIELDS: INHERENT COMPUTATIONAL DIFFICULTIES IN MOMENT-METHOD FORMULATIONS. Adams, R. W.; Miller, E. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Nov 1974. Contract W-7405-eng-48. 63p. Dep. NTIS $5.45.

Tangential and radial near fields, linear charge densities, and current distributions are calculated with seven thin-wire modeling programs using varying basis and weight functions and numerical treatments. The test case geometry is a half-wave, 1-m linear dipole with $\Omega = 15$. Each program is explained briefly and compared with similar codes. The results are presented graphically, and some basic observations are made. (auth)

19128 (UCRL-76275) MODEST PROPOSAL FOR VECTOR EXTENSIONS TO ALGOL. Zosel, M. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1974. 12p. (CONF-750302-1). Dep. NTIS $4.00.

From proceedings of the ACM conference on programming languages and compilers for parallel and vector machines; New York, New York, USA (18 Mar 1975).

Machines that possess instructions that are actually "higher level" than high-level language statements require extensions to traditional programming language. The kinds of extensions necessary for adequate access to the CDC STAR instruction set are examined. Specific problem areas considered are: access to the vector instructions, definition of descriptors, support of the variety of hardware data-types, and facilities for memory and register management. It is fairly straightforward to define language facilities to cover most of these problems with minimum disruption of existing language features. Informal descriptions are given for syntactic and semantic extensions to ALA, an ALGOL based language. Features include declaration and usage of vector and descriptor variables, generation of vector values, subscripting slicing, and procedure linkage. The language constructs described are not limited in application to either the STAR or ALA. They should be easily adaptable to other languages and machines where vector constructs would enhance programming power. (auth)

19129 (UCRL-76287) VECTOR EXTENSIONS TO LRLTRAN. Zwakenberg, R. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Dec 1974. 24p. (CONF-750302-2). Dep. NTIS $4.25.

From proceedings of the ACM conference on programming languages and compilers for parallel and vector machines; New York, New York, USA (18 Mar 1975).

The CDC STAR-100 brings a new concept in computing to LLL. The STAR is a string(vector)- oriented machine that is most efficient when it performs the same operations on sequentially stored operands. This approach to computer design opens up new areas of problem-solving techniques. Some algorithms that are long and cumbersome on other machines can be easily and efficiently programmed on the STAR computer. The vector extensions described represent an attempt to expand LRLTRAN (a dialect of FORTRAN) into a useful computer language for the STAR. The additions will enable an LRLTRAN-language compiler to produce vector code and hence allow the programmer access to, via LRLTRAN, the powerful STAR hardware instructions. (auth)

Miscellaneous

19130 (CONF-750105-1) COMMON TRENCHING: STATE OF THE ART. Boegly, W. J. Jr.; Griffith, W. L.; Compere, A. L. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 24p. Dep. NTIS $4.25.

From 54th annual meeting of transportation research board; Washington, District of Columbia, USA (Jan 1975).

In urban areas expansion of existing utility systems and the possibility of adding additional utilities will produce increasing competition for the available installation space. Also, installation and maintenance of these utilities will cause pavement cuts resulting in more frequent repaving and traffic congestion. Common trenching, or the installation of multiple utility lines in a single trench, offers the potential for reducing the number of places in which pavement cuts would be made. The first reported installation of more than one utility in a single trench was in Illinois in 1960. In 1968 changes in the National Electrical Safety Code allowed random separation of power and communication cables. In a 1969 survey of electric utilities, 30 out of 33 utilities said that they had used some form of common trenching with telephone companies. The English made a detailed study of common trenching for use in public housing developments and developed standard trench designs and suggested coordinating and operating procedures. Many of these procedures are applicable to the United States. One suggestion, for example, was the use of a single crew for installation, which has proved to be very successful in the United States. Major areas of concern to the utilities are coordination, compatibility, and cost sharing. Based on literature information it appears that cost savings of from 10 to 20% can be anticipated by using common trenching. In addition, if the use of common trenching allows the developer to complete and occupy housing faster, the developer will experience a greater rate of return on his investment. (auth)

19131 (JINR-E2-8264) REALIZATION OF gl(n,R) IN TERMS OF RATIONAL FUNCTIONS OF BOSE OPERATORS. Palev, T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

A realization of the algebra of the general linear group of rank n + 1 is constructed in terms of rational functions of n pairs of Bose creation and annihilation operators such that the Casimir operators are diagonal. It is shown that in the case of gl(2,R) one obtains in this way all representations of the algebra. (auth)

19132 (JINR-P10-8355) POINT DISPLAY FOR MINI COMPUTER M-6000. Kornev, V. I.; Nikul'nikov, A. V.; Prikhodko, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1974. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A point display for mini computer M-6000, its main characteristics, principle of operation and interface logic are described. The point display is intended for data representation on the CRT and for the use in the data processing. (auth)

19133 (LA-5698-MS) MEASUREMENTS OF X-RAY SCATTERING AT 90° IN SELECTED BERYLLIUM FOILS AT FLUORESCENT ENERGIES FROM 3.312 TO 10.532 keV. Bennett, E. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1974. Contract W-7405-eng-36. 8p. Dep. NTIS $4.00.

The x-ray scattering cross section at 90° was measured for five beryllium foils ranging in thickness from 0.0076 cm (3 mils) to 0.127 cm (50 mils). Fluorescent sources used were potassium, scandium, titanium, vanadium, chromium, iron, nickel, copper, zinc, and arsenic. Results are presented in the form of graphs of the apparent cross section, square centimeters per gram per steradian, plotted against photon energy. A strong Bragg peak is observed corresponding to reflection from the 002 planes in beryllium (4.893 keV at 90°); several other peaks are inferred through comparison with other data. Between Bragg peaks the observed cross section follows the incoherent scattering cross section. (auth)

19134 (LA-UR-74-1944) ESSENCE OF ARMED FUTILITY. Westervelt, D. R. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 13p. (CONF-741229-1). Dep. NTIS $4.00.

From 34th symposium of the Military Operations Research Society; Fort Eustis, Virginia, USA (3 Dec 1974).

Data from unclassified sources are analyzed in order to estimate the near and longer term countersilo capabilities of U.S. and U.S.S.R. fixed-base ICBM forces. It is concluded that projected Soviet deployments in the near term threaten 60% of the MM forces in a first-strike; with predictable accuracy improvement the entire force would later be placed in jeopardy. In either case, current views on fratricide suggest that 70% of the Soviet ICBM force would remain after the initial attack. U.S. force modernization for improved countersilo capability, combined if necessary with a launch-on-warning strategy, would permit destruction of most of the remaining Soviet ICBM's in a disarming second-strike. Feasible changes in MM III yield and accuracy would provide the necessary capability, particularly if MM III deployment is expanded. The generally accepted notion that instability results from ICBM vulnerability (the "first-strike premium") is questioned; mutual vulnerability can destroy that premium, by establishing the expectation that a first-strike will lead to substantial elimination of the attacker's remaining ICBM forces. If (and only if) a disarming second-strike capability is developed by the U.S., any Soviet attempt to achieve a disarming first-strike capability would be the essence of armed futility. The argument applies equally in the reverse direction. "Stability" thus depends on maintaining either mutually invulnerable or mutually vulnerable ICBM forces, to the extent that other forces can be discounted. Failure by the U.S. to respond to growing vulnerability of its MM forces, by matching Soviet countersilo capability at each step, could lead to disaster. On the other hand, such improvement in the U.S. force as is required, if it does not conspicuously overmatch the Soviet capability, should not lead to instability; on the contrary, it is necessary if instability is to be avoided. (auth)

19135 (LBL-3323) NEGATIVE MUON SPIN ROTATION AND SOLID STATE STUDIES. Yamazaki, T.; Nagamine, K.; Nagamiya, S.; Hashimoto, O.; Sugimoto, K.; Nakai, K.; Kobayashi, S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 24p. (CONF-740633-4). Dep. NTIS $4.25.

From international conference on hyperfine interactions studied in nuclear reactions and decay; Uppsala, Sweden (10 Jun 1974).

The principle of the muon spin rotation method is described with emphasis on possible applications to solid-state studies. Some experimental results of negative muon spin rotation experiments at Lawrence Berkeley Laboratory are given: g factor measurements in diamagnetic metals and relaxation phenomena in transition metals. (auth)

19136 (ORO-3992-198) CONSTRAINTS ON THE CONICAL EXPANSIONS IN HYDRODYNAMICAL MODELS. Chiu, C. B.; Wang, K. H. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 5p. (CPT-242). Dep. NTIS $4.00.

It is shown that for a conical expansion of ideal fluid, all hydrodynamical quantities such as proper energy density, proper entropy density, proper temperature, etc., cannot admit any angular dependence. In the hydrodynamical model, Landau's treatment on the conical expansion does not satisfy this constraint. (auth)

19137 (UCRL-76015) SMOKE HAZARDS FROM BURNING PLASTICS. Gaskill, J. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1974. 16p. (CONF-741223-1). Dep. NTIS $4.00.

From educational services meeting on plastics and fire problem; El Segundo, California, USA (5 Dec 1974).

Smoke hazards to people and property from unwanted fires have attracted increasing attention. The use of plastics in construction, furnishings, clothing, and recreational and transportation equipment has increased. Actual fire experiences indicate that organic materials, whether natural or man-made, will burn; those with large surface areas such as films, fabrics, or foams will ignite readily and burn rapidly. Addition of fire retardants to the plastic structure will inhibit ignition, surface flame spread, and combustion products with understrable properties. Among these are increased smoke density and carbon monoxide production. Studies indicate that certain fire-retardant plastic combinations yield very toxic products when exposed to heat such as might be encountered in a fire. Therefore, smoke from fire in a confined space involving these fire-retarded systems must be regarded as quite hazardous if smoke is defined in a larger sense than from the historical viewpoint. (auth)

19138 (UCRL-76177) FIRE/ARSON PREVENTION AND DISASTER PREPAREDNESS. MacBain, Z. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Nov 1974. 20p. (CONF-741135-1). Dep. NTIS $4.00.

From legislative security training conference; Sacramento, California, USA (6 Nov 1974).

The following areas in the fire prevention/protection field are explored: fire characteristics, fire prevention, arson prevention, liaison with local jurisdictional agencies and disaster planning, and fire protection/detection systems. (MCW)

Chemistry

19139 (AECL–4754) FOAMABILITY OF AQUEOUS SOLUTIONS: ALCOHOLS AND FATTY ACIDS. Cribbs, S. C.; Given, R. M.; Sagert, N. H.; Strathdee, G. G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Nov 1974. 34p. Dep. NTIS (US Sales Only) $4.75. AECL $1.00.

The foaming behavior of aqueous solutions of lower alcohols and fatty acids has been investigated by blowing nitrogen through the solution in a closed recirculating system. Generally the foam height, H, could be expressed as $H = k_0 + k_1V + k_2V^2$, where V is the linear gas velocity and the k's are constants. The k_2V term was dominant with the alcohols, whereas the k_1V term was dominant with the acids. At high flows the acids often showed a higher power dependence than V^2. The k_2's increased with the alcohol chain length, and the alcohols with an odd number of carbon atoms had higher k's than ones with an even number of carbon atoms. There was no marked difference between n-amyl and i-amyl alcohols. Some foaming was observed when $d\gamma/dc$

was immeasurably small. Foaming under these conditions cannot be explained by the classical model for foam stability. However, the maximum in k_2 was reached when $d\gamma/dc$ was large, in agreement with the classical picture. These foams were very wet, the liquid fractions being about 40%. As a result, none of the models relating to drainage of a stable foam column could be applied. (auth)

19140 (CEA-N-1734) AUTOMATIC DETERMINATION OF AMMONIUM. Application to the Determination of the Total Nitrogen Contents of Soils and Plants: Exchangeable Ammonium, Total Exchange Capacity of Soils. Saas, A. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Service de Recherches Toxicologiques et Ecologiques). Jul 1974. 16p. (In French). Dep. NTIS (US Sales Only) $4.00.

A method is presented for determining ammoniacal nitrogen contents after chemical attack in aqueous solution. It can be used to determine the total nitrogen contents of both soils and plants. The utilization of indophenol blue (obtained in the presence of hypochlorite) was extended to the determination of the total exchange capacity of soils and the quantity of ammonium exchangeable in soils. Colorimetric measurements were made with an accuracy of about 2%. The errors occurring in the absolute nitrogen values vary between 2 and 5%. (FR)

19141 (COO-2026-19) STUDIES IN CHEMICAL REACTIVITY. Carr, R. W. Jr. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science). [nd]. Contract AT(11-1)-2026. 17p. Dep. NTIS $4.00.

Measurements of relative amounts of $CH_2(^3B_1)$ and $CH_2(^1A_1)$ from ketene photolysis at 313.0 nm were done. Relative primary process yields of these species were computed, and a mechanism for ketene photodecomposition was deduced. Ketene photolysis in the presence of cis-2-butene at wavelengths shorter than 300 nm yielded evidence for $CH_2(^1B_1)$ production, which may commence in the vicinity of 2700 to 2800 Å. Preliminary measurements of the rate of the reaction $CH_2(^3B_1)$ + cis-2-butene have been done by flash photolysis-time resolved mass spectrometry. Mathematical modeling of effusive flow from the reactor into the mass spectrometer ionization chamber of the flash photolysis-time resolved mass spectrometry apparatus was performed. The modeling delineates the time resolution of the apparatus. An investigation of the mechanism of the reaction between hydroxyl radicals and propylene has been started, using steady illumination methods. Application of RRKM theory to the methylene plus cyclobutane chemical activation system is being used to deduce information on the collisional deactivation of highly vibrationally excited methylcyclobutane. (auth)

19142 (LBL-2743) THEORY OF THE DISSOCIATION OF DIATOMIC MOLECULES AND A STUDY OF THE EMISSION OF IF. Birks, J. W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1974. Contract W-7405-eng-48. 155p. Dep. NTIS $10.75.

Thesis.

The extent to which diatomic molecules dissociate from all vibrational levels was investigated by calculating from first principles the collision cross sections for dissociation of H_2 from particular vibration-rotation levels upon collision with Ne atoms. The $Ne-H_2$ potential energy surface was first calculated by the multiconfiguration self-consistent-field (MCSCF) and configuration interaction (CI) methods. A Monte Carlo classical trajectory study using this surface resulted in cross sections that are smaller than those required to accurately fit the experimental data, when incorporated in a nonequilibrium model of dissociation kinetics. Because of the threshold nature of the dissociation process for all but the highest vibration-rotation levels, the classical cross sections are considered to be a lower bound to the true quantum mechanical cross sections. The potential energy surface has the interesting property, previously found for the $He-H_2$ surface, of contracting the H_2 molecule as the Ne atom approaches. The surface demonstrates a cross-over point where the contractive force changes to a stretching force. Such a cross-over was predicted for $He-H_2$ by Secrest, but points on the $He-H_2$ surface have not yet been calculated in the region of this cross-over. An experimental study of the emission spectra of IF in the gas phase reaction of I_2 with F_2 is reported. (auth)

19143 (LBL-3319) CHEMICAL EVOLUTION. Calvin, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 18 May 1974. 45p. (CONF-740576-1). Dep. NTIS $5.25.

From conference at the Mitsubishi Kasei Institute of Life Sciences; Tokyo, Japan (18 May 1974).

A discussion is presented in a time sequence, that period in the time sequence in which the molecules themselves were being formed and transformed and built up to reach a size and complexity that could contain and sustain the living process leading to life. The essence of the molecular nature of living things is arrived at by chemical means. An attempt is made to reconstruct those possible processes from what is known about today's chemistry. The elements described in molecular terms begin with the appearance of small molecules (amino acids), then the appearance of polymers of those amino acids and nucleic acids to give large molecules that ultimately have specific structure, and then give rise to specific shapes and sizes. This involved the evolution of molecules, the evolution of polymers, the evolution of catalysts, and the evolution of information such that these processes can be repeated over and over again, leading to biological evolution ultimately. (MCW)

19144 (LBL-3542) CATHODIC REDUCTION OF POTASSIUM IN PROPYLENE CARBONATE ELECTROLYTES. Chacon, O. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1974. Contract W-7405-eng-48. 56p. Dep. NTIS $5.75.

Thesis.

Metallic potassium was electrodeposited at room temperature from 0.5 to 1.0 m $KAlCl_4$ and KPF_6 solutions in propylene carbonate (PC). Good quality deposits were obtained in electrolysis continued for up to 150 hours at current densities up to 30 mA/cm^2. Careful removal of impurities from the solutions was necessary to assure absence of discernable attack of potassium by the electrolyte. The effect of current density, temperature, and deliberately added low level concentration of water, propylene glycol, and propylene oxide on the appearance of the deposit were observed. Overpotentials were determined by both transient and steady state techniques. Assuming simple charge transfer rate limitation, the exchange current, i^0, in these solutions appears to be in the range of 10^{-5} to 10^{-7} amp/cm^2. Deviation from Tafel behavior indicates, however, that other rate limiting steps may play a dominant role above 1 mA/cm^2. (auth)

19145 (UCID-16624) CONCEPT FOR A MINIATURE GAS CHROMATOGRAPH. Kalibjian, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Oct 1974. Contract W-7405-eng-48. 18p. Dep. NTIS $4.00.

Significant advances in the miniaturization of gas chromatographs can be made by using micro-electronics technology. Open-channel capillaries can be made by utilizing the very narrow (~2μm) deep (~100μm) grooves that can be preferentially etched into Si. Also, packed columns of a few hundred μm in diameter can be backfilled with porous compounds (about 20μm particle size) by chemical vapor deposition techniques. With the trade-off in the square root of channel length to channel width or particle size, considerable shortening of the column length can be made without any loss in resolution as compared to a conventional chromatograph. Detection sensitivity can be enhanced considerably by operating the ionizing detector in vacuum. For heavy gas detection, separation of heavy ions from a light ion carrier gas in a miniature electrostatic analyzer can enhance also the threshold detection level. (auth)

19146 (UCRL-Trans-10713) COMPUTATION OF THE END POINT OF POTENTIOMETRIC TITRATIONS WITH PROGRAMMABLE MINICOMPUTERS. Ebel, S.; Kalb, S. Translated from Z. Anal. Chem.; 260: 345-350(1972). 15p. Dep. NTIS $4.00.

In principle, potentiometric titrations are based on two types of instrumentation: either the electrode potential is recorded against titrant consumption in analog fashion and the resulting potentiogram is evaluated by one of the known graphic methods (tangent method, arc method, or intersection method) or the titrant is added in discrete volume steps and a digital printout is provided of the potential or potential difference. In the latter case, the end point is subsequently evaluated by computation. (auth)

Life Sciences

19147 (BNL-19403) SYNTHETIC PROTEASE INHIBITORS ACTING BY AFFINITY LABELING. Shaw, E. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 25p. (CONF-740973-1). Dep. NTIS $4.25.

From meeting on proteases and biological control; Cold Springs Harbor, New York, USA (10 Sep 1974).

Affinity labelling techniques were used to study the inactivation of chymotrypsin and trypsin by protease. Molecular mechanisms involved in the selective inhibition of trypsin-like enzymes in vitro are discussed. (CH)

19148 (BNWL-SA-5216) APPLIED SYSTEMS ECOLOGY: MODELS, DATA, AND STATISTICAL METHODS. Eberhardt, L. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 43p. (CONF-750202-1). Dep. NTIS $5.25.

From conference on systems ecology; Logan, Utah, USA (20 Feb 1975).

Applications of systems analysis techniques, including biological models, mathematical models, statistical methods, and computer analysis of data are discussed. (CH)

19149 (CEA-CONF-2615) TENTATIVE CORRELATIONS BETWEEN SOME SPECTROSCOPIC AND BIOLOGICAL PROPERTIES OF PHENOTHIAZINE AND PARAFLUOROBUTYROPHENONE DERIVATIVES. Leterrier, F.; Thiery, C. (Centre de Recherches du Service de Sante des Armees, 92 — Clamart (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 — Gif-sur-Yvette (France). Dept. de Biologie). 1973. 18p. (CONF-7306104-1). Dep. NTIS (US Sales Only) $4.00.

From third international symposium on phenothiazine and structurally related drug; Rockville, Maryland, USA (25 Jun 1973).

Results are reported from studies of the absorption, fluorescence, phosphorescence, and electron spin resonance spectra of 20 phenothiazine and 19 parafluorobutyrophenone derivatives. (CH)

19150 (CONF-741227-2) BIOLOGICAL AND CHEMICAL EFFECTS OF CIS-DICHLORODIAMMINEPLATINUM (II) ON DNA. Munchausen, L. L.; Rahn, R. O. (Oak Ridge National Lab., Tenn. (USA)). 1974. 16p. Dep. NTIS $4.00.

From southwest regional ACS meeting; Houston, Texas, USA (9 Dec 1974).

It has been proposed that the mechanism for the antitumor activity of cis-dichlorodiammineplatinum (II), cis-Pt $(NH_3)_2Cl_2$, involves binding of the platinum to cellular DNA. Current knowledge of the mode of binding to DNA has been based largely on model system studies. From such studies the suggestion has been made that platinum acts like a bifunctional alkylating agent and binds preferentially, but not exclusively, to guanine. Recently it has been shown by means of analytical sedimentation that in a competitive reaction between the platinum complex and two different DNAs, the platinum complex prefers to react with the DNA of the higher GC content. The work presented here confirms guanine as the preferred binding site, proposes a model for the observed stoichiometry, and attempts to relate this binding to observed macromolecular and biological events. (auth)

19151 (CONF-750104-1) CULTURE OF THE MANGROVE OYSTER, CRASSOSTREA RHIZOPHORAE GUILDING, IN PUERTO RICO. Watters, K. W.; Prinslow, T. E. (Puerto Rico Nuclear Center, Mayaguez). 1975. 19p. Dep. NTIS $4.00.

From world mariculture society meeting; Seattle, Washington, USA (28 Jan 1975).

Results are reported from a study of the ecology of mangrove bays in Puerto Rico suitable for the culture of the mangrove oyster. (CH)

19152 (CONF-750202-2) IMPORTANCE OF VALIDATION IN ECOSYSTEM ANALYSIS. Mankin, J. B.; O'Neill, R. V.; Shugart, H. H.; Rust, B. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 30p. Dep. NTIS $4.50.

From conference on systems ecology; Logan, Utah, USA (20 Feb 1975).

The role of models in ecosystem research is discussed and concepts needed to evaluate the credibility and verisimilitude of dynamic ecosystems models are considered. (CH)

19153 (COO-1599-80) ROLE OF CALCIUM CARBONATE PRECIPITATION IN LAKE METABOLISM. White, W. S. (Michigan State Univ., Hickory Corners (USA). W. K. Kellogg Biological Station). 1974. 155p. Dep. NTIS $5.75.

Thesis.

During a two year period analyses were made every other week of sediments collected at three depths in a small hard-water lake in southwestern Michigan. The samples were analyzed for total dry weight, organic material, calcium carbonate, and ash content. During the second year seasonal changes in sestonic particulate organic carbon, Kjeldahl nitrogen, and total phosphorus were assayed. (CH)

19154 (LA-5796-PR) AUTOMATED CANCER-CELL SORTING AND ANALYSIS. Progress Report, April 1—September 30, 1974. Steinkamp, J. A.; Horan, P. K.; Martin, J. C.; Salzman, G. C.; Crissman, H. A. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 5p. Dep. NTIS $4.00.

The present effort centers on the development of suitable protocols for proper identification of malignant cells in clinical gynecological material; thorough testing of fluorescent markers and the associated protocols with well-characterized cell systems; with the success of goal (2), there follows a thorough evaluation with both normal and abnormal gynecological material of the preparational and staining procedures; and improvements and modifications of the LASL and NCI cell sorters. Particular emphasis is placed on development of a simplified flow chamber and an evaluation of light scattering as an appropriate marker for cervical-vaginal material. (auth)

19155 (LA-5824-PR) SEROLOGIC TEST DEVELOPMENT. Annual Report, July 1, 1973—June 30, 1974. Saunders, G. C.; Clinard, E. H.; Payne, R. J. (Los Alamos Scientific Lab., N. Mex. (USA)). Jan 1975. Contract W-7405-eng-36. 13p. Dep. NTIS $4.00.

Both the soluble antigen fluorescent antibody (SAFA) and the enzyme-labeled antibody (ELA) serological test systems appear to be useful tools for disease surveillance programs in domestic food animals. The SAFA test has proven to be a rapid and reliable method for detecting trichinosis in experimentally infected swine. The SAFA test appears to be able to detect infected animals before the physical methods are able to do so. Problems remain in preparing a reliable antigen for the ELA test for hog cholera. However, ELA appears to work well for swine trichinosis and brucellosis. Early test results of using ELA to detect tuberculous swine are very encouraging. The concept of employing ELA for multiple disease screening has been successfully demonstrated. Preliminary experiments suggest the possibility of using ELA to detect Staphylococcus A Enterotoxin in food products. (auth)

19156 (LBL-3607) STABILITY OF RIBONUCLEIC ACID IN SOLUTION: MODEL CALCULATIONS. Levine, M. D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1974. Contract W-7405-eng-48. 247p. Dep. NTIS $15.50.

Thesis.

Model calculations on oligoribonucleic acids were performed in order to gain a quantitative understanding of factors which contribute to the stability of double stranded RNA molecules in solution. (CH)

19157 (ORNL-NSF-EATC-10) CYCLING OF MERCURY AND CADMIUM IN AN OLD FIELD ECOSYSTEM DURING ONE GROWING SEASON. Matti, C. S.; Witherspoon, J. P.; Blaylock, B. G. (Oak Ridge National Lab., Tenn. (USA)). Feb 1975. Contract W-7405-eng-26. 82p. Dep. NTIS $7.25.

Thesis. Submitted by C. S. Matti to Univ. of Tennessee, Knoxville.

Results are reported from a study of the cycling of cadium and mercury in an old field ecosystem during one growing season in which solutions of $^{203}Hg(NO_3)_2$ and $^{109}CdCl_2$ were used as tracers. (CH)

19158 (ORO-4157-7) HUMORAL AND NEURAL INFLUENCES OF THE CENTRAL NERVOUS SYSTEM ON HEMOPOIESIS AND BEHAVIOR. Progress Report, February 1, 1974—August 31, 1974. Berkut, M. K. (North Carolina Univ., Chapel Hill (USA). Dept. of Biochemistry). 18 Oct 1974. Contract AT(40-1)-4157. 29p. Dep. NTIS $4.50.

Results are reported from experimental animal studies on the regulatory control of erythropoiesis by the central nervous system. (CH)

19159 (SAND-74-0393) BIOLOGICAL SURVEY OF KIRTLAND AIR FORCE BASE (EAST). Martin, W. C.; Wagner, W. L. (New Mexico Univ., Albuquerque (USA). Dept. of Biology). Dec 1974. Contract AT(29-1)-789. 63p. Dep. NTIS $6.00.

This survey provides an annotated checklist of the species of flora and fauna whose patterns of distribution extend into this area of New Mexico. Also presented is a classification of the vegetational and animal associations occurring in the area surveyed, and a correlation of these associations with the plant communities of the Southwestern United States. (auth)

19160 (SGAE-2318) ADJUVANT-INDUCED POLYARTHRITIS IN RATS. Hruby, R. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Aug 1974. 9p. (In German). (BL-101/74). Dep. NTIS (US Sales Only) $4.00.

A modified method to produce an adjuvant-induced arthritis in rats was developed, which proved to be very successful. Each animal was treated with an intraplantar injection of 1 mg lyophilized Mycobacterium tuberculosae H 37. About three weeks later in 80% of the rats a particular extreme arthritis developed especially in the articulations of the extremities. (auth)

19161 (UR-3490-658) EFFECTS OF CARBON DISULFIDE ON OPERANT BEHAVIOR IN PIGEONS. Levine, T. E. (Rochester Univ., N. Y. (USA)). 1974. 125p. Dep. NTIS $9.50.

Thesis.

Results are reported from studies on the effects of carbon disulfide (CS_2) on the behavior of pigeons, in which operant conditioning techniques were used. (CH)

Materials

19162 (BNL-19301) WESTERN MAYA FINE PASTE POTTERY: CHEMICAL AND PETROGRAPHIC CORRELATIONS. Rands, R. L.; Benson, P. H.; Bishop, R. L.; Chen, P. Y.; Harbottle, G.; Rands, B. C.; Sayre, E. V. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 30p. (CONF-740951-1). Dep. NTIS $4.50.

From 41st international congress of Americanists; Mexico City, Mexico (2 Sep 1974).

The archaeological study of the Western Maya fine paste pottery resulted in the multidisciplinary collaboration focusing on fine paste pottery as a possible guide to more extended cultural contacts. Although early attempts to delimit zones of intensive ceramic trade employed a number of analytical methods, including spectrography and x-ray diffraction, the major approach was microscopic. A second converging set of activities leading to the present concern with the fine paste problem was the trace element analysis of Fine Orange and Fine Gray pottery by neutron activation leading to the recognition of a chemical compositional group referred to as Matching Fine Orange. The wider scope of the investigation resulted from the fact that a series of fine paste groups, in addition to the better-known Fine Orange and Fine Gray Wares, was abundantly represented in the Palenque area survey. Correlations between chemical and petrographic data currently available are graphically represented. (MCW)

19163 (CEA-CONF-2703) SEMI-MICROSCOPIC THEORY OF INVAR MAGNETISM. Natta, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). 1973. 6p. (CONF-7309131-1). Dep. NTIS (US Sales Only) $4.00.

From conference on soft magnetic material I; Turin, Italy (3 Sep 1973).

The microscopic properties of INVAR are discussed in the framework of a generalization of the Landau theory; they are consistent with the R. J. Weiss hypothesis of a first order local transition around 29% of nickel and also the observation of a hysteresis in pulsed field experiments at 77°K. (auth)

19164 (CEA-CONF-2754) LIQUID CRYSTAL MATRIX ADDRESSING DISPLAY (M. A. D.). Robert, J.; Labrunie, G.; Borel, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). 1974. 9p. (CONF-740241-1). Dep. NTIS (US Sales Only) $4.00.

From international solid state circuits conference; Philadelphia, Pennsylvania, USA (13 Feb 1974).

Design considerations and experimental results concerning a nematic liquid crystal cell used in an ac cross-bar addressing mode to achieve a page composer for holographic memories or an information display device are reported. The display is a 128 × 128 binary elements page composer utilizing the electro optical effect of index modulation in an homeotropic nematic liquid crystal. It acts as a spatial wave polarization modulator. A matrix addressing display is described made of two glass plates of optical quality and coated with indium oxide electrodes that can be used as a black and white or color display. The liquid crystal device permits data to be written into holographic optical memories, to design systems for digital or analog data processing, and to display information either in black and white or in color. (MCW)

19165 (LA-5829-MS) HIGH-TEMPERATURE VACUUM THERMAL STABILITY TESTS OF EXPLOSIVES. Baytos, J. F. (Los Alamos Scientific Lab., N. Mex. (USA)). Jan 1975. Contract W-7405-eng-36. 11p. Dep. NTIS $4.00.

Twenty-six explosive compounds, candidates for high-temperature applications, were subjected to vacuum thermal stability tests at 200, 175, and 150°C for periods up to 90 days. RDX, HMX, and TNT were also run at the lower temperatures for comparison. The test results are given in tabular form, grouped by temperature, and in graphical form by compound for the three temperatures. (auth)

19166 (LBL–2775) ROLE OF DEFORMATION INDUCED PHASE TRANSFORMATIONS IN THE PLASTICITY OF SOME IRON-BASE ALLOYS. Zackay, V. F.; Bhandarkar, M. D.; Parker, E. R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 83p. (CONF-740840–2). Dep. NTIS $7.25.

From 21st sagamore army materials research conference on advances in deformation processing; Raquette, New York, USA (13 Aug 1974)/

Microstructural changes in alloys can be induced by phase transformations. While many phase transformations are thermally activated, some are not. An important example of the non-thermally activated type is the deformation induced phase transformation. Deformation induced phase transformations are known to cause unusual changes in the mechanical properties of ferrous and non-ferrous alloys. It has been shown that this type of transformation can considerably enhance the mechanical properties of high strength austenitic alloys or TRIP steels. Useful combinations of toughness, strength, and ductility can be obtained in these steels by control of the composition and the processing. TRIP steels are thermomechanically processed in the austenitic state. During this thermomechanical processing, changes occur in both chemistry and substructure, and these alter the stability of austenite with respect to deformation during subsequent mechanical testing. The present paper discusses the several compositional, processing, and testing variables that influence this austenite stability. It is shown that the strength, ductility, stress-strain behavior, fracture toughness, fatigue properties, and corrosion resistance of TRIP steels are strongly affected by austenite stability. The considerations involved in designing TRIP steels, their limitations, and some of the steps that have been taken to overcome these limitations, are reviewed. Recent studies are described in which attempts were made to incorporate the TRIP phenomenon in other classes of steels. These include non-nickel cryogenic steels and low and medium alloy quenched and tempered ultra high strength steels. (auth)

19167 (LBL-2783) VAPOR PHASE ETCHING KINETICS OF GaAs. Bissinger, R. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 14 Jun 1974. Contract W-7405-eng-48. 109p. Dep. NTIS $8.50.

Thesis.

Thermal evaporation of (001) GaAs was investigated along with the simultaneous etching by HCl in the presence of H_2. Two kinetic regimes were proposed based on the nonlinear Arrhenius plot of the free evaporation rate. In the first regime, at temperatures above 1000°K, the rate exhibited an apparent activation energy of 72 kcal/mole with respect to the HCl; in the second regime, at temperatures below 910°K, an apparent activation energy of 14 kcal/mole was observed. (MCW)

19168 (LBL-3151) EFFECT OF A LONG RANGE INTERATOMIC POTENTIAL ON THE STABILITY OF CRYSTAL LATTICES. Krause, C. W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 127p. Dep. NTIS $9.50.

Thesis.

The mechanical and phase stability of metallic crystal lattices is studied with a long range interatomic potential that describes the bonding between atoms in the lattice. Particular attention is accorded to phenomena related to the shear of close-packed planes across one another in close-packed polytypes. The long range potential, which oscillates with increasing interatomic separation, can be partially summed to obtain an interplanar interaction that is particularly useful for the study of shear phenomena. Use of the interatomic potential, referred to as the Friedel potential, and the interplanar interaction allow the calculation of the relative energies of competing lattice structures, of phonon dispersion relations, elastic constants, stacking fault energies, and the determination of the effects of finite homogeneous deformations of simple metallic crystals. The various phenomena and structures are studied at constant volume and as a function of the valence of metallic alloy. (auth)

19169 (LBL-3384) PROBABILISTIC APPROACH TO PLASTICITY IN POLYCRYSTALLINE MATERIALS USING DISLOCATION MECHANICS. Sackett, S. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 8 Nov 1974. Contract W-7405-eng-48. 93p. Dep. NTIS $7.75.

Thesis.

A set of constitutive equations for polycrystalline plasticity that is fully consistent with thermodynamic requirements is derived. The idea of randomly distributed glide plane orientations and Burger's vector directions is introduced to facilitate handling of the polycrystalline structure. This yields equations involving probability distributions for variables that are directly related to measurable dislocation quantities. When the motion of the dislocations is isochoric, the tensorial character of the plastic strain rate is shown to be entirely determined by a second rank symmetric tensor directly related to ordinary elements of crystallographic glide. This same tensor is also shown to determine to shear stress acting on a dislocation. Characteristic yield conditions are calculated for several sample materials in which the dependence of the dislocation velocity on stress is given by an empirical power function. The shape of the yield surfaces for these materials is shown to vary from that of von Mises when the exponent is small to that of Tresca when the exponent is large. Additional examples illustrate the ability of the proposed theory to model such phenomena as the development of anisotropy during plastic deformation, material hardening and softening, the occurrence of upper and lower yield points, and Bauschinger effect. (MCW)

19170 (NP-20240) SPECIAL REPORT: CRITICAL IMPORTED MATERIALS. (Council on International Economic Policy, Washington, D. C. (USA)). Dec 1974. 116p. GPO $1.90.

19171 (ORNL-tr-2865) DEFORMATION AND FAILURE OF HARDENED CEMENT PASTE AND CONCRETE UNDER A SHORT-TERM LOAD. Zaitsev, Iu. V. Translated from Cem. Concr. Res.; 1: 123-137(1971). 15p. Dep. NTIS $4.00.

Methods of fracture mechanics are applied to concrete and hardened cement paste in compression. A simplified model of a brittle porous material is introduced. Using this model, solutions of problems of crack propagation in the neighborhood of one and two pores are given. Using Monte Carlo method, crack propagation in a material with random distributed pores is analyzed. Theoretical predictions are compared with existing experimental results. (auth)

19172 (ORNL-tr-2869) X-RAY DIFFRACTION STUDY OF Au–Cu ALLOYS OF COMPOSITION INTERMEDIATE BETWEEN THAT OF $AuCu_3$ AND AuCu ALLOYS (35-37 AT. % Au). Belbeoch, B.; Jehanno, G. Translated by Martha Gerrard from J. Appl. Crystallogr.; 6: 371-380(1973). 15p. Dep. NTIS $4.00.

A narrow two-phase region (of composition width about 1 at. %) separates alloys of types AuCu and $AuCu_3$ in the neighborhood of the composition $Au_{36}Cu_{64}$. A tetragonal deformation of the unit cell is observed as much in the ordered $AuCu_3$ I structure as in the periodic antiphase structure, AuCu II, the deformation being due to preferential occupation of certain sites by gold atoms. Two one-dimensional periodic antiphase structures of the type $AuCu_3$ II are observed, with one antiphase direction parallel to a, $AuCu_3$ II′–α, the other parallel to c, $AuCu_3$ II′–c. The symmetry of the elementary cell of $AuCu_3$ II′–α would appear to be not tetragonal but orthorhombic. (auth)

19173 (ORO–3935-43) STUDY OF ALLOY STRENGTHENING DUE TO ATOMIC ORDER. Progress Report, May 1, 1974–April 30, 1975. Marcinkowski, M. J. (Maryland Univ., College Park (USA). Dept. of Mechnaical Engineering). 1975. Contract AT(40-1)-3935. 5p. Dep. NTIS $4.00.

Research is reported on the application of atomic ordering to the understanding of the mechanical behavior of metals and alloys in general. The study of the behavior of interacting non-coaxial dislocation glide loops is reported. Since dislocations are generally nucleated as loops at random sites within a crystal and eventually expand so as to come into proximity with one another, such interactions are of extreme importance in understanding the work hardening of both ordered as well as disordered alloys. In both classes of materials, the dislocations may meet one another to form dipoles, or else pass one another, or, in the case of screw type dislocations, they may cross slip with resultant mutual annihilation. (MCW)

19174 (ORO-3947-11) ELEVATED TEMPERATURE MORPHOLOGICAL STABILITY OF METAL MATRIX FIBER COMPOSITES. Final Report. Courtney, T. H. (Texas Univ., Austin (USA)). Jun 1974. 17p. Dep. NTIS $4.00.

The elevated temperature use of metal matrix fiber composites is predicated on their microstructural stability in both static and cyclic high temperature environments. Some results of thermal stability studies are reported for the isothermal stability in the Al–Al_3Ni eutectic. A direct measurement of the velocity of lamellar fault migration was performed on the Pb–Sn eutectic. An isothermal stability study of the Cu–Cr rod eutectic is made and it is one of the few rod-like eutectics in which both the fiber and matrix are metallic in nature and in which the fiber is essentially circular and without facets, indicating an isotropic surface energy. Aspects of eutectic growth and mechanical behavior were studied. (MCW)

19175 (SAND-74-5821) COMPUTATIONAL TECHNIQUES FOR BOUNDARY LAYERS. Blottner, F. G. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 51p. (CONF-750207-1). Dep. NTIS $5.75.

From course in computational fluid dynamics; Brussels, Belgium (17 Feb 1975).

The present status of the numerical computation of boundary layers is given for two- and three-dimensional flows. The appropriate transformations to apply to the governing equations are considered, and the possible solution procedures are discussed. The finite-difference procedures are illustrated for the two-dimensional, incompressible flows. For compressible flows the Crank-Nicolson technique is given. The changes that are needed to this approach, when the flow is turbulent, are presented. The finite-difference procedures utilized for unsteady flows are given. Solution techniques for three-dimensional flows are described and the features that are different from two-dimensional flows are emphasized. (auth)

19176 (SGAE–2329) THERMAL DESORPTION PHENOMENA ON SURFACES IN VACUUM. Final Report. Moraw, G. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.). Sep 1974. 94p. (In German). (PH–166/74). Dep. NTIS (US Sales Only) $7.75.

The thermal desorption of gases on metallic surfaces of steel, Al, and Cu was studied for the purpose of finding materials with low outgassing rates and methods for the reduction of gas desorption from surfaces. The degassing rates, gas diffusion, and the activation energies for the diffusion and thermal desorption were measured for these metals. The diffusion and desorption processes were first mathematically analyzed. The various methods for the measurement of the degassing rate were compared. The results obtained for the thermal desorption of H_2, H_2O, CO, CO_2, CH_4, and O_2 were reported and analyzed. On the basis of the results obtained it was concluded that Al or vacuum-degassed or oxidized steel are preferable for ultrahigh vacuum installations because of their small outgassing rates. (JSR)

Physics and Engineering

19177 (AERE-R-7849) UPGRADING THE FIELD HOMOGENEITY OF A 220 MHz n. m. r. SPECTROMETER. Baker, C. A. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Oct 1974. 16p. Dep. NTIS (US Sales Only) $4.00. UK 50 pounds.

The design and construction of a transverse quadrupole shim set is described. The improved field homogeneity obtained reduced the intensity of spinning side bands from 2% to ½% and conferred other desirable characteristics on the instrumental performance. (auth)

19178 (CEA-CONF–2702) STUDY OF A BACKGROUND GAS PENETRATION INTO A FREE JET SHOCK WAVE STRUCTURE BY MONTE CARLO METHOD. Rosengard, A. (CEA Centra d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Chimie-Physique). [nd]. 8p. (CONF-740743–1). Dep. NTIS (US Sales Only) $4.00.

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974).

19179 (COO-1574-38) EXPERIMENTAL AND THEORETICAL STUDIES IN LOW TEMPERATURE PHYSICS: SUBLIMATION AND VAPOR PRESSURE OF ^{36}Ar AND THE COMBINED EFFECTS OF PHONON ATTENUATION AND IMPEDANCE MATCHING ON KAPITZA RESISTANCE. Opsal, J. L. (Michigan State Univ., East Lansing (USA)). 1974. 127p. Dep. NTIS $9.50.

Thesis.

The sublimation and vapor pressure of Ar^{36} were measured in the temperature range 23.752 to 87.375 K. Pressures below 1 torr were measured with a McLeod gauge and corrected for effects of thermal transpiration and mercury streaming. The data were fit to theoretical sublimation pressure curves to obtain values for the static lattice energy, lattice vibrational energy, and geometric mean frequency of the phonon spectrum. The data were also compared with theoretical calculations of others based on an anharmonic self-consistent phonon theory. Equivalent sublimation-pressure data on normal Ar are compared with Ar^{36} data in the temperature range 62.315 to 84.503 K. The Kapitza resistance, $R_K(T)$, is calculated for a Cu–He^4 interface using the acoustic mismatch theory of Khalatnikov and of Mazo and Onsager. Included in the calculation are the effects of phonon attenuation in the copper as well as impedance matching due to the increased He density near the interface. (MCW)

19180 (ITEF-48) FAST-SLOW ELECTRONIC CIRCUITS OF TIME MEASURING SYSTEMS. Barkov, B. P.; Katinov, Yu. V.; Sutormin, A. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 35p. (In Russian). INIS.

A description is given of fast-slow electronics, a unit for converting information to numerical form, and also electronic units for tuning and verifying electronic equipment having an exact point of time reference. (tr-SJR)

19181 (JINR-P9-8182) VACUUM DIODE WITH THE EXPLOSIVE EMISSION OF ELECTRONS. Dolbilov, G. V.; Koshelev, V. I.; Sumbayev, A. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A setup intended for the vacuum diode investigation is described. The energy parameters of the electrons emitted from the cathode with the explosive emission were investigated. The Volt-Amper characteristics of the diode and the rate of the interval communication were measured. The electrons of the energy exceeding the cathode voltage were observed. (auth)

19182 (KFHTI-72-50, pp 3-10) EFFICIENT OIL-DIFFUSION PUMPS. Vodolazhskii, S. N.; Nikolaev, G. T.; Sinel'nikov, K. D.; Yamnitskii, A. N. 1973. (In Russian).

In Vysokoproizvoditel'nye diffuzionnye paromaslyanye nasosy.

This study describes two powerful oil diffusion pumps M-20 and M-4 having pumping rates of 20,000 and 40,000 l/sec respectively. The high-vacuum pump MM-1000 was the prototype of these pumps. The method of designing these pumps with a given pumping rate is presented. The construction of the pumps is described, and the operating characteristics are given. The booster pump B-200 and the diffusion pump M-4 are also described. The test results on pump M-4 are presented. (tr-SJR)

19183 (LA-5802-MS) EXPLOSIVE LOGIC CIRCUITS. Parkinson, J. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

A study of explosive logic circuits is described. Parameters studied were minimum cross section of XTX 8003, matrix materials, null gate designs, corner turning ability, and spacing requirements in the selected material. A prototype circuit with two inputs and three outputs was designed, constructed, and tested. A null gate for 0.5-mm-wide by 0.5-mm-deep full radius track was developed, tested, and used in the prototype circuit. (auth)

19184 (ORNL-HUD-MIUS-16) MIUS TECHNOLOGY EVALUATION: COLLECTION, TREATMENT, AND DISPOSAL OF LIQUID WASTES. Boegly, W. J. Jr.; Spiewak, I.; Thomas, D. G.; Reed, S. A.; Griffith, W. L.; Compere, A. L.; Wright, H. W. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 170p. Dep. NTIS $7.60.

Liquid waste collection, treatment, and disposal may be performed within the utility framework of a modular integrated utility system (MIUS). A MIUS can serve from 100 to 3000 dwelling units and any associated facilities. The small size and self-contained nature of a MIUS create special situations with respect to the application of liquid waste collection and treatment technologies. Technology evaluation is a continuing process in the MIUS program, especially in liquid waste management, since it appears that a number of new concepts in liquid waste collection and treatment may become economically feasible in the near future. A summary of the evaluation completed to July 1973 is given. First, some introductory material on quantities and composition of sewage that might be generated in housing complexes (such as those served by a MIUS) is presented, along with a discussion of the possible role of water-saving devices. Next, possible alternatives to the use of gravity-flow sewerage systems are discussed. Individual unit processes that might be used in liquid waste treatment and disposal are then described. System flow sheets for the production of effluents of various qualities and at various costs by the different unit processes are presented and discussed in the next section, along with information on electrical and thermal requirements. An analysis of commercially available small sewage treatment plants using the various unit processes is included in the next section, the costs of the plants are given, and a possible method for estimating the relative economy of on-site processing, compared with transporting the sewage to an existing treatment plant for processing, is outlined. Finally, possible schemes for the reuse of treated liquid waste effluents from on-site plants used in MIUS complexes are discussed. (MCW)

19185 (SAND-74-0388) PRESSURE MEASUREMENTS NEAR AN ELECTRICAL ARC DISCHARGE IN A LIQUID. Huff, C. F.; Silva, R. S. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 24p. Dep. NTIS $4.25.

The pressure pulse generated by an electrical arc in a liquid was measured with a lithium-niobate piezoelectric transducer. These are the first time-resolved pressure pulse measurements made close to an electrical discharge in a liquid, and were made possible by the unique properties of the crystal and the gage design. The measurements were made at distances as close as 0.5 cm from the electrodes, which is only several times larger than the arc channel. The experimental setup and the results obtained are discussed. (auth)

19186 (SAND-74-5474) CHARGE-PUMPED CONTROL CIRCUITRY FOR A SERIAL ACCESS 336 BIT MNOS ELECTRICALLY ALTERABLE ROM. Dodson, W. H.; Heightley, J. D.; Alfisi, V. J.; Lodi, R. J. (Sandia Labs., Albuquerque, N. Mex. (USA); Sperry Rand Research Center, Sudbury, Mass. (USA)). 27 Sep 1974. 8p. (CONF-750208-1). Dep. NTIS $4.00.

From IEEE international solid-state circuits conference; Philadelphia, Pennsylvania, USA (12 Feb 1975).

A 336 bit MNOS EAROM was designed for 10 year nonvolatile storage of data. This single chip design is fully decoded and all voltages required for erasing, writing, and reading the MNOS transistors are totally controlled on chip in a manner that eliminates circuit threshold drops. All data input-output pads and all control pads are compatible with 15 volt CMOS. The low power PMOS circuitry developed for this design is described. (MCW)

19187 (UCRL-75320) AUTOMATION TRENDS. Frazer, J. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Apr 1974. 11p. (CONF-740314-5). Dep. NTIS $4.00.

From 25th Pittsburgh conference on analytical chemistry and applied spectroscopy; Cleveland, Ohio, USA (4 Mar 1974).

Digital computer automation and related technological breakthroughs are forces resulting in changes in chemical and physical measurements. The important features of these complex measurements are occurring in process control in manufacturing processes; quality control; problems associated with the control of pollution; and clinical analysis. It is predicted that instruments will be interconnected in a distributive and/or hierarchical computer system due to the need for transmission of information, instrument control from remote sites, for software development, and improved scientific management. The methodology for future instrumentation is followed for the nuclear fuel industry. A procedure ASTM E-31 helps implement digital computer automation systems. (MCW)

19188 (Y-1966) DIRECT DIGITAL NUMERICAL CONTROLLER FOR MACHINE TOOLS. Bowers, G. L.; Lay, C. M.; Williams, T. L. (Oak Ridge Y-12 Plant, Tenn. (USA)). 28 Jan 1975. Contract W-7405-Eng-26. 54p. Dep. NTIS $4.00.

A direct digital numerical controller (DDNC) was developed as an alternative to the current numerical control (NC) concept with the expectation of improving the performance and the design criteria for an NC controller. The need for a DDNC was prompted by a program to decrease the time required for machining special, low-volume, custom-made parts. DDNC offers several improvements over commercially available NC, such as: (1) magnetic core memory replacement of the tape reader during machining, (2) capability of remote loading via a high-speed transmission line from the computer, (3) part-description data stored in highly efficient binary format rather than EIA code, (4) size savings of 75% in required floor space with a significant reduction in circuit components and accompanying maintenance, and (5) greater than 50% cost savings. Full, five-axis, continuous-path contouring (using linear interpolation) is available on the DDNC with manual control features basically the same as those found on NC units. DDNC units were installed on three Ex-Cell-O two-axis turning machines, and a number of parts were machined. DDNC proved to be a practical, economical, and reliable method for machine-tool control. (auth)

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